

SYLLABUS FOR  
**ELECTRONIC MECHANIC**  
UNDER  
APPRENTICESHIP TRAINING SCHEME  
As approved by  
GOVERNMENT OF INDIA  
In consultations with  
CENTRAL APPRENTICESHIP COUNCIL

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### **General Information**

1. Name of the : Electronic Mechanic
2. N.C.O. Code No. : 852.20
3. Duration of Craftsmen Training : 2 years
4. Duration of Apprenticeship Training : 3 years
5. Entry Qualification : Passed in Matriculation Examination under 10 + 2 system of education with Mathematics and Science or its equivalent.
6. Rebate for Ex-craftsmen Trainees : 2 years (Mech. Radio & T. V. or Mech. General Electronics)
7. Ratio of Apprentice to Workers : 1:5

## LIST OF MEMBERS OF THE TRADE COMMITTEE

### CHAIRMAN

Shri P.K. Chakraborty  
Director

CSTARI, Calcutta

### MEMBERS

S/Shri

1. B. Sarkar,  
Asstt. Works Manager  
Rifle Factory  
Ishapur
2. Debal Kr. Roy,  
Service In-charge  
Keltron, Calcutta
3. D. Basu  
Jt. Director  
ERTL, Calcutta
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Asstt. Director  
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Calcutta
5. A.K. Das Sharma  
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I.T.I. Anudh,  
Pune
10. S.K. Pal  
Station Engineer  
A.I.R.  
Calcutta
11. S.R. Pal  
Joint Director  
CSTARI  
Calcutta

### SECRETARY

B.K. Chatterjee

CSTARI,

Training Officer

Calcutta.

**SYLLABUS FOR THE TRADE OF ELECTRONIC MECHANIC  
UNDER CRAFTSMEN TRAINING SCHEME**

Period of Training: 2 years

Note: 1. The syllabus given below is a guide for the Instructors 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 should be given on problems related to the trade according to the syllabus given for Workshop Calculation and Science.

Note : 2. BIS Publications for components and measurements for Radio and TVs are available as standard publications. The Instructors should emphasis the use of these specifications during course of teaching.

No. of Weeks	Syllabus List	Theory	Practical	Equipment Required	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5	6	7
1.	Know your Institute	(a) Organization of the Institute Departments various trades & functions (b) Types of work, responsibility to be undertaken, incentives and future. Planning of profession © Safety precautions to be observed in the trade oath during 'Theoretical Periods' and 'Practical hours/workshop hours.' (d) Elementary First Aid (e) Earthing types and importance.	(a) Visit to the Institute (b) Introduction with the Principal & other teaching staffs. © Demonstration of various systems of the 'Trade' like Radio, Tape, and T.V. controls, etc. (d) Care & Safe working habits, safety precautions to be demonstrated to the trainees. (e) 'Elementary First Aid' practice, 'Artificial respiration' practice	Power Supply switch gears. Fire extinguishers First Aid Kit First Aid Chart Artificial Respiration Chart Instrument boxes and Drawing materials  Students tool kits and workshop tools	What is Engineering Drawing? Importance, Free hand sketching of St.lines, rectangles, square, circles, polygons, etc.  Free hand sketching of tools. Reading of simple drawings and concept of dimensions and dotted lines, chain line etc. Magnifying glass	Introduction to electricity supply systems.  Properties and uses of metals and non-metals related to trade. Copper, Zinc, Tin Aluminum, Brass, Bronze
2. & 3.	Hand Tools	Identification, specifications, uses and maintenance	Demonstration & uses of trade hand tools-Screw-			

		of hand tools	driver,plier,etc.Simple mechanical fixtures, types of screws, bolts, washers, clamps, rivets, taps, connectors. Simple fitting practice, fitting and drilling practice. Simple threading practice Simple sheet metal works. Demonstration on Pneumatic screw driver.			
4.	Introduction to Electricity	Matter, molecule, atom, conductor, Insulator, Semi-conductor, Classifications, voltage, current, resistance, Ohm's Law, specific resistance & O.S.W.G.	Identification of conductors, Insulators, with specifications. Use S.W.G. demonstrations of different soldering iron. Practice of soldering & de-soldering. Practice of simple series and parallel ckts and mixed. Verification of OHM's Law.	S.W.G. Multi-meter soldering iron. Temp. controlled soldering station.	Reading of simple drawing, Free hand sketching of simple solids with dimension	Solder Timber, Rubber Diff. types of P.V.C. Materials used in Electronic Industry.
5.&6.	Resistors	Classification of resistors with specifications & use. Construction of resistors. Colour Code. Kirchhoff's Law and its application. Explanation and only use of multimeter	Identification of resistors. Colour code practice. Use of multimeter measurement of voltage, current and resistance. Experiments on P.T.C.resistors " " " N.T.C. resistors " " " Thermister resistors PTC VCR Resistors PTC LCR Resistors Tests on and use of classified resistors Carbon (various W), W/W, PCT(Log & Linear) Pre-set,etc.	SWG Millimeter Soldering iron. Lead acid Battery, cells, Multimeter.	Free hand sketch of solids viewed perpendicularly to their surface and axes	Use of diff. Sheets ferrous and non-Ferrous. Decimals addition, subtraction, Multiplication, division ,conversion of decimals to common fractions and vice versa.
7.	Battery	Explanation of cells. Leclanches cell. Primary cells, Secondary cells, Battery construction-charging rate. Efficiency-Amp.hr.capacity.	Testing of primary and secondary cells. Use of cells and battery in ckts. Preparation of Electrolyte.Preparation of Charging by a charger. Use of sp.gr.tube/	Assorted cells and batteries Assorted rheostat, Hydrometer. Battery charger, Battery	Free hand sketches of nuts & bolts with dimensions from samples. Ckts and wiring diagram.	Reduction of common fraction to decimals fractions. Brief description of manufacturin

		Types of charging-Silver oxide. L.C.R.bottom cells. Alkali cells-construction-charging efficiency-use, advantages.	Hydrometer	Tester, Cells Tester		g process of steel, copper, aluminium.
8.& 9	Electro-Magnetic	Explanation of magnetism. Classification of magnets and their materials. Properties of magnets, uses and preparation of artificial magnets. Magnetic needle. Magnetic keepers. Explanation of Electro-magnetism. Properties advantages, disadvantages-application-types of cores. E.M.relays-types-uses. Concept of generators & motors only. Principle classification. To build up E.M.F.in a generator only starting of a D.C.motor only miniature motors.	Demonstration on the properties of P.M. Use of magnetic needle. Simple practice of converting a magnetic materials into a magnet by a bar magnet. Preparation of a solenoid. Use of magnetic needle. Preparation of a solenoid. Use of magnetic needle. Preparation of electro-magnets for a calling bell/buzzer. Preparation of E.M. relay. Testing of types of relays. Rewinding of E.M. Relays & small repairs. Building of E.M.F. in a Generator starting of a D.C. Shunt motor	Assorted paramagnets. Magnetic needles. Assorted Bells & Buzzers. Assorted relays. D.C.Shut generators/ motor. Small assorted D.C. motors.	Expl.of simple orthographic projection 1 <sup>st</sup> angle.	Metric system metric weights and metric measurements, units conversion factors. Manufacture of plastic and resins.
10.&11.	Alternating Current	Explanation of A.C.Comparison with D.C.Expl. of Induction & induced E.M.F. Faraday's Law, Lenz's Law A.C. Generator-Left hand and Right hand rules. Instantaneous values R.M.S.VALUES-Phase-cycle-Time period-frequency. Single phase motor. Three phase motor. Fractional H.P.Motors..Capacitor motor	Demonstration of A.C. & D.C. Demonstration on Induced E.M.F. Demonstration on L.H. & R.H. Rules. Demonstration on Instantaneous values and R.M.S. values. Demonstration on phase, cycle, 'f' Measurement A.C. voltages and current Principle classification uses.	Oscilloscope A.C. Auto var Models on L.H. & R.M.rules. Low Frequency Oscillator Multimeter 'f' Counter	Expl. Of simple Orthographic Projection 3 <sup>rd</sup> angle.	Meaning of tenacity Elasticity Malleability brittleness hardness compressibility and ductility with examples.
12.	Inductance	Define-Inductance. Explanation of Inductive reactance, types specification. Behavior with A.C.Impedence. Coil concept-	Identification of assorted inductive reactance's-checking, testing & rewinding unto a specification. Impedance & P.F.measurements.	Oscilloscope A.C. Auto Var Models on L.H.&R.H. Rules. Low frequency	Expl. of simple Orthographic Projection 3 <sup>rd</sup> angle.	The weight of a body, units of weights & shop problem percentage & its

		power factor. Self & mutual induction coefficient of coupling. Expl. Of Transformer-types-turns ratio-uses-losses-efficiency. Hysterisis & eddy current-types of cores to be used for L.F.H.F. & V.H.F. Transformer.	Demonstration on self and mutual induction. Identification of assorted transformers-testing and rewinding up to a specification.	Oscillator. Multimeter 'f' counter  Assorted Inductive reactances. Assorted Transformers.		application. Shop problems.
13.	Capacitance.	Expl.of capacitance & capacitive reactance. Classification of capacitors with specification Electrostatic action dielectric constants, materials used. Series and parallel Connection. Colour cores uses.	Identification and testing of different types capacitors. Colour code practice. Behaviour of capacitor at different frequencies	Bridges-RCL or Digital Multimeter, Power supply, Oscillator, E.V.M.	Expl.of simple orthographic projection 3 rd angle.	C.G.S.M.K.S And their conversion problem.
	Resonance	Expl.of resonance. Importance-equations Series and parallel resonance. Ckt.elements-natural resonance, tuning, voltage gain Anti-resonance ckt.of faster. Uses in electronic ckts.	Determination of resonance. Characters for series and parallel. Turning to a given 'f'	Oscilloscope, signal generator E.V.M.	Simple isometric drawings, isometric views of simple objects such as square, cube rectangular blocks. Detailed diagram of Electromagnets.	Ratio and proportion shop problems, plotting and reading of simple graphs. Works unit of work, energy power.
14 to 16	Simple Analogue Meters	What is meter ? Importance of meter. Classification of meter. Forces necessary to work a meter. M.C. Instruments. M.I. Instruments. Universal Instruments. Range Extension of meters. Need of calibration. Multimeter. Characteristics of meters. Use of meters in different ckts. Use of multimeters. Servicing, care & maintenance. Use of Insulation tester.	Demonstration on the function of M.C. & M.I. meters Measurement of resistance, voltage, current frequency, etc. by Am-meter, Voltmeter, frequency meter. Expts on 'range extension' of meters. Use of multimeters. Servicing of multimeters. Servicing of multimeters. Demonstration on calibration of meters Demonstration on insulation tester.	Assorted analogue meters. Multimeters. Models/ Kits for assorted Ckts. Shunt & series Resistors. Standard Meters.	Familiarising and sketching the details of components.	Applied problems. Algebraic symbols addition, subtraction, multiplication division. Standard algebraic formula $(a+b)^2$ . Simple simultaneous equations with two unknown measuring of friction examples, meaning of C.G.

17.	Semi-Conductor	Define 'Semi-conductor' Intrinsic & Extrinsic semi-conductors. Temperature coefficient. Definition of 'P' and 'N' types of semi-conductor. Development of P.N.Junction-Barrier potential symbol. Symbols as per B.I.S./graphic.	Film on Semi-conductor. Film on P.N. Junction. Demonstration on Barrier-Potential for G & Si.	Video Films on Semi-Conductor Video Films on P.N. Junction Digital Multimeter	Use of drawing instruments. 'T' Square, drawing board construction Of simple figures & solids with dimensions.	Specification gravity Balancing examples.
18 to 19	DIODE	Expl. of Diode Classifications of Diodes. Characters of Diode. Zener diode. Temperature effect. Diode as rectifier-Half wave-Full wave Bridge Coding of Diodes. Study of the diode function parameter.	Testing of a Diode. Characteristics of Diode. Characteristics of Zener-diode. Half wave rectifier ckt. Full wave rectifier Ckt. Bridge rectifier ckt.	Multi-Meter E.V.M. Oscilloscope	Use of different types of scales in inch & millimeters. Lettering numbers and alphabets.	Areas of rectangles, circles, regular, polygons, Calculation of areas, volume, weight of simple solids-cubes squares, hexagonal prisms shop problems.
20.	Filter Circuits	What is filter circuits? Types of Filter circuits. expl.of XC ,X L. Hipass, Low pass, Band pass filters	Demonstration on various filter ckts. Assembly, testing & 'L' 'T' & PAI filters Demonstration on H.P., L.P., & B.P. Filter circuits.	Multi-Meter oscilloscope	---	Heat and temperature thermometric scales- Fahrenheit, centigrade and their conversion Kelvin Reamer Celsius.
21. to 23`	Transistor	Bi-polar junction Device. Expl. of transistor. Types of transistor. Tests of transistor. Symbol as per B.I.S.Biasing of Transistor & mode of application. Arrangement of a Transistor in a ckt. Conditions for the use of a transistors, current flow in a transistor, ALPHA & BETA of a transistor. Thermal run way, Transistor CB, CC, CE amplification.	Identification and testing of a transistor. To study alpha & Beta of a transistor/characteristics of a transistor (Static and Dynamic). To study the function of a transistor as an amplifier.	Multimeter, millimeter, micro-ammeter, millivoltmeter. Transistor tests. Signal Generator. Oscilloscope	Drawing of various electrical ckts. With B.I.S.symbols of ckt.series and parallel ckt. Power transformer instrument transformer,etc.	Meaning of stress modules of Elasticity, ultimate strength B-11 curve.
24 to 26	Amplifier	Explanation of Amplifier 'f' spectrum. Classification of Amplifiers, Class	Demonstration, assembly and testing of a transistor amplifier in Class A,B,C, P-P	Multimeter, D.C.Low voltage power supply.	Free hand sketching of plan & elevation of simple objects-	Simple problems on Lines, angles, triangles and



		A.B.C.A-B A.F.amplifier-wave – length, propagation, Val. of sound, Hi-fi, .R.F. amplifier. Voltage amplifier. Small signal, Large signal, Signal to noise ratio. Power amplifier-types. Push-pull, Complementary symmetry (transformers output) Thermal stability and heat dissipation. Biasing and couplings. Frequency compensation, pre-amplifier. Cascading of amplifiers. FC of amplifier. Vol.control tape control, bass control, Treble control and master control P.A. system.	complementary symmetry modes. Assembly, testing and frequency response of a single stage A.F. amplifier and R.F. amplifier. Assembly, testing and frequency response of a five stage amplifier with voltage amplifier and power amplifier. Study of P.C.B. of an amplifier. Fault location and servicing of a amplifier. Study of Vol.tone, Bass, Treble and master control ckts.	Signal generator. A.F. -Do- R.F.HF oscilloscope output meter.	hexagonal bar, Sq.bar, circular bar, tapard bar, hollow bar, etc.	circles.
27 to 30	Power Supply	Explanation of power supply, Importance, types-un regulated, regulated-types of regulation. Stabilizers-types. On S.M.P.S. Blocks Investor ckts. And convatorckts. Blocks of U.P.S.	Demonstration of various power supply. Assembly & testing of an unregulated power supply. Assembly & testing of a series regulated, shunt regulated F.S. Assembly & testing of a voltage stabilizer as per specifications to be used for a T.V. Refrigerator. Demonstration on U.P.S. system. Assembly & testing of a S.M.P.S. for C.T.V.	Reading of simple ckts.	Calculation of areas of triangles. Polygons with the aid of trigonometry.	
31 to 33	Stereo system	Explanation of sound propagation, sound, importance of channels in sound system. Explanation of microphones-types, uses specifications etc. Explanation of Loud-Speakers-types matching of speakers/Horns/ Baffles/enclosures.	Demonstration and testing of various microphones. Identification, testing servicing of microphone spares. Identification testing & servicing of Loud Speakers. Arrangement of speaker/Horns in a room/ Auditorium & for an open gathering. Impedence matching.	Assorted micro-phones. Assorted Loud-Speakers. Assorted Horns A.F. amplifier Line transformer . Multi channel stereo	Symbols as per different semi-conductor devices L.D.R., V.D.R. thermister, & their use in ckts.	Calculation of current voltage, in voltage dividing network using thermister, V.D.R., L.D.R. at different temp., voltage, light intensity etc.

		Line transformers. Explanation of stereo system. Stereo amplifiers. Arrangement of stereo for a specified area. Surround sound systems.	Demonstration on 2/4/6 channel stereo system.	system. Multimeter E.V.M. oscilloscope		
34 to 35	Intercom	Definition & Explanation of 'Intercom' system. Block diagram of 'Intercom' system. Explanation of cradles/ Receiver types, function and testing. Explanation of 'Ex-changes' used, Explanation of power supply.	Demonstration of 'Intercom' system. Study of cradles/ Exchanges. Study of power supply of 'Intercom' system. Fault finding and Servicing of 'Intercom' system.	12 line intercom system with 'exchange' Multimeter.	Drawing of A.F. amplifier ckt. With six stage and with types of out-put P-P.	To calculate current in different resistive network using Diode. Zener in F.B. & R.B.
36 to 38	Oscillator	Define oscillator Importance, applications to electronic Ckts Explanations of vibration and oscillation. Factors controlling oscillations Types- A.F.-R.F. Feed back, Tank ckts, crystal oscillator, Oscillators-used in Radio ckts, T.V.ckts. Tape recorder. etc. Function Generator other applications of oscillators. Tone generation, Remote etc.	Demonstration on various oscillators. Study of Feed back in an oscillator ckt. Assembly of an A.F. oscillator testing & measuring the 'f' of generated oscillations. Study of an R.F. oscillator. Fault finding & servicing of oscillator.	Various AF & RF oscillators. Multimeter oscilloscope. Frequency counter. Remote control Devices- Toys etc.	Block diagram of an oscillator. Symbols for different wave shapes – square, Saw tooth, Sine, Triangular etc.	Calculation of 'f' V from $f = \frac{v}{\lambda}$ Time period Giga heat z Mega heat z Micro etc,
39	Modulation	Define modulation types of mode- A.M. F.M., P.M. – application Broadcasting. Bandwidth mode index. Definition and importance and démodé.			Drawing of AM & FM modulated wave at various nmodulation- 100 pc, 50 pc. Etc.	Determination of Velocity ratio, mechanical advantage & efficiency
40 to 42	Radio Receivers	Full explanation of Radio receiver Superheterodyne principle of 'frequency changing' chain, terms used in radio transmission- Ionosphere, ground wave propagations Electromagnetic	Demonstration on a multiband Radiko Receiver. Study of radio ckt. M.W. -DO- Multiband. Identification of R.F. stage. Identification of I.F. stage Identification of A.F.	Assorted Radio Receivers (Multiband ) Multimeter oscilloscope	Exercise on Blue print reading/ckt. Reading of house service connections and small power ckts. Connection of Ammeter Volt meter, Watt-meter Kwh	Logarithm. Use of log-tables for multiplication and division. Determination of efficiency of simple machines-

		waves, reflection, speed of transmission, wave length. Explanation of 'frequency' ranges Resonance. Image frequency, acceptor ckt. & rejector ckt. Disadvantages of R.F. amplification. Sensitivity and selectivity. Fidelity. Singnal to noise ratio. Block diagram of a radio receiver.	stage. Study of assorted 'Bank Switches' Practice on 'Dial Threading' Study of the PCB of the R/Rckt.		meter with I.S.I.symbol ckt.reading and drawing of different stages of R/R/. Free hand sketching of trade objects.	Wrench, pulley blocks, wheels and compound axles.
43.	Tuning Section (R.F. Section)	Explanation of tuning section/R.F. Section. Block diagram Antenna ckt. Oscillator ckt. Mixer stage. I.F. generation. R.F. amplifier A.G.E., types of transistors used. Specifications of Ant. & oscillator coils with types of 'Gang condensers.' Types of 'band' switches. Used-connections conditions for better selectivity ant. Sensitivity.	Study of R.F. section of R/Rs for both P.N.P./N.P.N. Ant. & oscillator alignments. Study of different band switches. Fault finding and servicing of R.F. stage. Checking of selectivity. Checking of sensitivity.	R/R-both P.N.P. and N.P.N. Multimeter signal generator. Oscilloscope D.C. power supply	Ckts.of magnetic controller with dynamic breading. Drawing of conversion. Stage of R/R/ both PNP/NPN. Layout of Battery charging ckt. From D.C. Shunt generator.	Problems of mensurtion, Sq.hexagon, Prism Atmospheric pressure, pressure gauges, absolute pressure properties of matter.
44.	I.F. Stage And Detection	Explanation of I.F. the importance of I.F. range for M.W. & S.W. Ckt. Analysis of I.F. stage. Transistors/I.C. used their characters. Alignment of I.F. stage. Explanation of detection/demodulation. R.F. by pass. Tuning indicators with their ckt. Arrangement types. A.V.C./A.G.C. Line, importance.	Study of I.F. Stage of R/R for both PNP/NPN. Study of detector stage of R/R/ for both PNP/NPN. Study of A.V.C./S.G.C. ckt. Alignment of I.F.T. for desired I.F. for desired I.F. Testing of I.F.T.s. replacement of I.F.Ts. and realignment.\ Fault finding by meter/by signal traces/by scope.	R/R-both N.P. and N.P.N. Multimeter E.V.M. Signal Generator. Signal tracer oscilloscope	Drawing of I.F. Stage of both P.N.P. and N.P.N. ckts.	Defect of force on material in such applications as extending, bending, twisting and shearing. Trigonometric tables, applied problems.
45.	Audio Stage	Explanation of audio stage, types of amplification, driver stage, output stage. Transistors used. Tone control, Vol.	Study of Audio stage, driver stage, output stage, tone and vol. Control stage. Fault finding and servicing.	-do-	Details of electrical control panel	Calculation of bias. Determination of gain of air at different load.

		Control.				
46 to 48	Fault Finding	Preparation of servicing charts for fault finding in Audio Amplifiers are in R/Receivers. Data sheet & history sheet. Replacement charts/equivalent charts.	Servicing practices	Signal tracer Oscilloscope	Drawings of C.B., C.E. & C.C. Ckts Typical voltage Amplifier ckt Drawing of Class A & B amplifier ckt. Different power output stages P-P complementary symmetry etc.	Simple calculation of power output and ilasing.
49 to 50	Record Player & Changer	Expl.of record player and record changer, block diagrams. Principle of operation of pickup (types) speed changer, mechanical assembly. Stylus adjustment, replacement study of the motors and speed control.	Demonstration on Record player and record changer. Study of Record Player.  Study of Record changer. Identification, testing & replacement various pick ups, idlers and motors- speed testing by stroboscope.	Record player Record changer stroboscope	Drawing of the mechanical assembly of speed changer. Drawing of transistorized R/R set	Simple problems on lefting devices. Solution of problems by vectors. Ex. On simple supported load. Calculation of area Vol. And weight of simple solids bodies- cubes, squares, hexagons, prism,.
51.	REVISION	+Need of standards-types of standards +National standards-diff. standard bodies-implementation.				
52		T	E	S	T	
	Achievement:	At the end of first year, trainees will be in a position to assemble/test and repair different power supplier, Audio amplifier and A.M. radio receivers				
53 to 58	Tape Recorder And Compact Disc.	Expl.of magnetic recording principle with block diagram types. Function & use of magnetic tapes, recording heads, erasing heads. Bias oscillator. Doily system. Motors used and speed control speeds of tapes. Care and maintenance idea of stereophonic	Demonstration on magnetic recording, play back, fast forward and Rewind Study of recording and erasing circuit. Study of Mechanical Assemble with motor. Cleaning of Heads. Fault finding and Servicing Study of 'Auto Stop'. Study of two-in-one circuit. Study of a car stereo circuit.	Tape Recorder i)Cassettee ii) Spool Multimeter i)	Block diagram of a tape recorder. Circuit diagram of C/L relay Drawing of a limit switch	Problems of mensuration General condition of equilibrium for series of forces on a body. Plotting of graper. Simple problems of graper. Brief description

		recording and reproduction system. Servicing charts. Specification of tapes and cassettes. Idea of standard Recorder. Idea of equalizers. Example of Car-Stereo system. Expl. of compact Disc system.	Azimuth correction. Demonstration on C.D. player.			and properties of silicon, Nichrome silver etc.
59 to 61	Special Semi-conductors	Expl. of characteristics, uses of U.J.T., F.E.T., M.O.S., F.E.T., S.C.R., S.C.S., S.B.S., C.DIAC TRIAC, I.C.	Study & assembly of a U.J.T. triggered ckt Study and assembly of F.E.T. amplifier ckt. Study of a ckt. Using MOSFET Study of a ckt. S.B.S. & S.C.S. Study of S.C.R. in D.C. Study of S.C.R. in A.C. Study of voltage control by S.C.R. Study of DIAC, Study of I.C. ckt.-amplifier, switching ckt.	Models of U.J.T. triggered ckt. FET as power Amplifier. Models as S.B.S. S.C.S Electronic power regulator. Analogue I.C. tester. Microprocessor kit. Oscilloscope Multimeter E.V.M. Function generator.	Drawing of U.J.T. triggered ckt. With I.S.I. symbol. Power amplifier ckt. with F.E.T., I.S.I. symbols of S.B.S., S.C.S. voltage regulator ckt. Motor control ckt. A.F. amplifier ckt is I.C. Remote control by L.S.I. and M.S.I. Block diagram of microprocessor Flow chart of microprocessor.	Problems on measurement problems. Atmospheric pressure. Pressure gauges Absolute pressure. Properties of Matter. The molecule and atoms. Different between mass and weight
62 to 63	Transmitter	Example of transmission systems. Block diagram. Frequency multiplier. Feeders & Antena & Phase modulation. Police wireless, microwave link and satellite communication. (Example & Block dia only)	Demonstration on various transmitting Systems. Study in blocks the ckt. Of transmitters.	Transmitter (if available)	(if drawing of ckt. Of signal generator, $E > V > M >$ function generator. d.c. speed control ckt. With $I > S > I >$ symbols.	Representation of forces by vectors, simple problems on lifting tackles Jig, wall cranes solution by vectors.
64 to 65.	Oscilloscope.	Expl. of oscilloscope, importance, applications. Block diagram. Introduction to VALVE only. Construction & function of C.R.T. – C.R.O. Use of C.R.O. Care and maintenance. Lissajer's fig.	Demonstration a C.R.O. Example of 'X' & 'Y' axes controls. Measurements of D.C. voltages, A.C. voltages frequency etc. Comparison of waver. Use of 'scope' in testing & fault location. Practice on scope for measurements. Test on Lissejus pattern.	C.R.O. , L.P. & H.F. signal generation 'VIDEO FILM' 'Oscilloscope'.	Drawing of Block diagram of oscilloscope, C.R.T. circuits diagram of oscilloscope.	General condition of equilibrium for series of forces on a body. Plotting of graph. simple equation of graphs.
66 to 75.	Television systems.	Expl. of T.V. systems B&W Block diagrams for	Demonstration on a B&W T.V. Identification of diff.	'Video film' 'How T.V.	Drawing of the block diagram of a T.V. set.	Trigonometric function – Use of

		both. Transmitter & Receiver. Idea about video camera. Scanning system. Frame, Field, Raster, Picture elements. Composite video signal. Aspect ratio, resolution, flickering, contrast, Brightness video signal, sound signal channels, Bands. Expl.data preparation for Tuners.- i)Mechanical ii)Electronic –do- Fitter ckt. SWAF –do- Video amplifier & picture tube –do- sweep section & E.H.T. –do- Sound Section –do- Power supply T.V. Antenna- YAGI & feeder cables.	Controls. -do- Tuner, testing & replacement. -do- wave trap ckt. & testing. -do- video I.F. –do- staggered tuning of video I.F. -do- Video amplifier –do- picture tube–do- sweep ckt. -do- Haizcutal- E.H.T. -do- F.M. Sound –do- section. -do- power supply -do- S.M.P.S. -do- S.T.R. -do- S.T.R. -do- Preparation servicing charts. Installation of T.V. Antenna.	works'. T.V. sets B&W make diff. Company With servicing manual. Pattern generator. Multimeter DATA Book T.V. demonstrati on kit. Sweep generator with 'X-Y' display.	Drawing of picture tube. -do- Electronic gum. -do- Deffection yoke. -do- Speaker -do- Video Amplifier ckt. -do-S.W.A.F. -do- E.H.T. ckt. -do- E.H.T.ckt -do- 'YAGI' Antenna -do- the circuit of wabbulator. -do- Vidicon camera-tube.	trigonometri c tables. Applied problems. Calculation of areas of triangles, polygons etc. Density of solids, liquids & simple experiment for its determinatio n. Magnetic deflection Theory Photo conductivity Demodula tion Principle.
76 to 83	Colour T.V.	Expl.of colour T.V. Functional Block diagram. Expl.ckt. description and test points of Tuner -do-V.I.F. -do- A.G.C. -do-Video Amplifier -do-Synchroni- sation & sweep ckt. -do-Matrix -do-Picture tube -do-Sound Section -do-Power supply Preparation of servicing charts/data sheet. Fault finding step by step. Balancing of white colour	Demonstration on C.T.V. Identification & use of diff.controls. Identification, study & test points of Tuner. -do- V.I.F. -do-Video Amplifier -do-Sync.ckt -do-sweep ckt. -do-Picture tube -do-Sound sec. -do-Power supply Fault finding. Adjustment of white colour	C.T.V.(diff. Make with manual. Colour pattern generator. Multimeter. CTV demonstrati on. Oscillo- cope. Sweep generator with 'X-Y' Display. Video film 'How CTV works'.	Drawing of different turner diagrams, V.H.F. Channel charts. Typical video I.F. response curve, staggered tuned amplifier ckt. F.M.detector response curve. Sound section ckt. Diagram	Qty. of heat, specific heat of solids, liquids & gases, Heat gained heat lost. Problems on mensuration. Resolution and composition of forces. Principle of video regarding. Cutting & bending of Aluminum pipes principle & calculations for different channels. Calculation of frequencies due to channel interference. Calculation of Video and Sound I.F. frequencies for different channels.
84 to 86	Commu-	Function Block	Study/demonstration	Model of	Drawing of	Simple

	nication System	diagram & Example of Telegraph system -do-Tele-Phone “ -do-Radio Photo “ -do-Trans Receivers -do-U.H.F.,V.H.F. micro wave and Radar system -do-Satellite system -do-Navigation I.L.S.	on Telegraph system. -do-Telephone -do-Digital phone -do-Trans receiver VISIT to Different Transmitting stn. (if possible) Video Film show on satellite communication.	Telegraph & Telephone system. Trans Receiver	separated sync. pulses, A.G.C.and sync separator ckt.	calculation of compensating components values for frequency ranges. Calculation of vorage dividing net work using resistance.
87 to 90	D.C. Motors	Expl. D.C.motor, parts required principle of operation, types, speed control by S.C.R./Diac and Triac. Example of micro meter	Demonstration in different types of motors study of speed control by <u>S.C.R.</u> By Diac & Triac Speed control of micro-meters.	D.C. motors, series , shunt, Micrometer Electronic Starter	---	Calculation of R.C. constant in A.G.C. ckt. Frequency calculation of R-C and L-C oscillator
91.	A.C. Motors	Expl.of principle A.C.1 phase motors, types, construction -do-3 Ph.motors	Identification, testing & running of 1 ph.motors -do- 3 ph. Motors.	Capacitor Motor Electric Fan Grinder Washing Machine	Power supply ckts. Solid state.	Calculation of voltage in resistive net work using V.C.P. Zener etc.
92 to 93	Wave Shaping Ckt  Timer  Operational Amplifier	Expl.of pulse/wave Shaping ckts. -do-Differentiation and Integration ckt.  Expl.of Timer, Types of Time constant etc.  Example of op-Amp.-uses.	Study of different pulse shaping ckts. Assembly & testing of a differentiation and a integration ckt.  Study of relay ckts. -do-D.C.timer  -do-A.C. timer -do-of op.Amp.ckt.	Function Generator oscilloscope. T.V. set	Drawing of different wave shaping ckt.,timer ckt. Of amp.etc.	
94 to 98	Digital Electronics	Expl.of Digital system, comparison with Analogue. Advantages-application. No.systems-Binary, Hex. conversion. Octal basic logic gates, Truth Table Multivibratory Memory, FLIP-FLOP, counter, Binary, M.S.I., L.S.I., V.L.S.I.C. mets & Bipolar and proper use.	Study of Digital I.C. Verification of logic gates. -do-Multivibrator -do-FLIP-FLOP -do-Counter	I.C.		
99 to 102	Specific Devices.	Study of 1.Photo devices 2.R.F.heating Introduction heating	Study of Photo devices. -do-R.F.heating ckt. -do-Temperature control ckt.	Models of photo device. a)operating ckt.		

		3.Thermocouple & R.T.D. 4. Level controls 5. Tacho generator 6.Alarm ckts. 7.Digital meter and introduction to 'micro-processor' & computer and perihherate 8.L.E.D. 9.Remote control	-do-Level control ckt. -do-Tacho generator ckt -do- Digital meter Demonstration on Ferasel computer -do-L.E.D. Remote control	b) R.F. heating ckt. c)Temperat ure control ckt. d)Level control ckt. e)Tacho generators f)Alarm ckt. g)Assorted Digital meter h)Personal computer		
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103. PROJECT WORK

104. REVISION

LIST OF TOOLS & EQUIPMENT  
FOR THE TRADE OF 'ELECTRONIC MECHANIC'

(For a batch of 16 trainees)

Sl.No. (1)	Description (2)	Quantity (3)
	<b>TRAINEES' KIT</b>	
01	Combination Pliers 15 cms. Insulated	16
02	Long nose insulated pliers 15 cms.	16
03	Diagonal cutter 15 cms insulated	16
04.	End Cutting nipper insulated 15 cms.	16
05.	Tweezers 10 cms.insulated	16
06.	Heat sink plier	08
07	I.C. Tweezer/Puller	16
08	Neon glow tester	16
09	Knob Screw driver insulated 10 cms	16
10	Screw driver set of 6	08
11	Watch maker screw	08
12	Knife electrician	16
13	Adjustable spanner/slide wrench (15-20 cis.)	08
14	Wire stripper	08 sets
15	Allen key	01 set
	<b>WORKSHOP TOOLS &amp; EQUIPMENT</b>	
16	Fire extinguisher	01 No.
17	Fire aid kit	01 NO.
18	Artificial Respiration Chart	02 Nos.
19	Work benches 120 x 400 x 75 cm	04
20	Rubber mat – 180 x 45 x 2.5 cm	03
21	Rubber gloves pair	01 set
22	Steel ruler 30 cm	08 nos
23	Scriber 15 to 20 cm	04
24	Centre punch 10 cm	04
25	Hammer crosspane 110 cm with handle	04
26	Hammer bar pane 220 cm with handle	04
27	Spanners double ended metric system 6 mm to 19 mm by 1.6	04 sets



	mm	
28	Spanners single ended 6 mm to 25 mm by 1.6 mm	02 sets
29	Box spanners set of (4-15)mm	01 set
30	Mallet 8 oz.`	02 Nos.
31	Gimlet	02 Nos.
32	Saw tenon 25 cms.	02 Nos.
33	Chisel wood 15 cms set of 6 mm to 25 mm	02 sets
34	Chisel cold flat 10 mm	02 Nos.
35	Hand shares metal cutting 25 cms	02 Nos.
36	Bradawl	02 Nos.
37	Ratchet brace drill 10 mm	02 Nos.`
38.	Electric drill 10 mm with polishing and buffing accessories	02 Nos.
39.	Hacksaw 20-25 cm (adjustable)	04 Nos.
40	Value based cutter	02 sets
41	Hand operated bending breake`	02 sets
42	Fly press 4 to 5 ton	01 No.
43	Junior saw 20 cms	02 Nos.
44	File flat 20 cms 2 <sup>nd</sup> cut	04 Nos.
45	-do- 15 cms bustard	04 Nos.
46	-do- half round 20 cms bustard	04 Nos.
47	-do- round 20 cms 2 <sup>nd</sup> cut	04 Nos.
48	-do- flat 20 cms.	04 Nos
49	Instrument files set of 12	02 sets
50	Vice Bench 10 cms Jaw	02 Nos.`
51	-do- 5 cms Jaw	04 Nos
52	Taps set 3 mm to 10 mm (set of 9)	02 sets
53	Dies set 3 mm to 10 mm	02 sets
54	Grinder bench electric	01 No.
55	Equipment soldering iron 35 W	20 Nos.
56	-do- 250 W	02 Nos.
57	-do- 65 W	20 Nos.
58	-do- 10 W	10 Nos.
59	Temperature controlled soldering station 15 W	01 No.
60	Disoldering pump and desolderwive	02 Nos.
61	Wire gauge set	02 Nos.
62	Feeler gauge`	02 Nos.
63	Permanent Bar magnet 15 cms	02 Nos.
64	Solenoid with core	02 Nos.
65	Electric Bells	16 Nos.
66	-do-	04 Nos.
67	Battery eleminator	08 Nos.
68	Battery storage lead acid	02 Nos.
69	Hydrometer	02 Nos.
70	Rheostats asserted vahes and rating	25 Nos.
71	Variable resistance/Potentiometer	25 Nos.
72	Fractional H.P. AC meters	02 Nos.
73	-do- DC	02 Nos.
74	Constant voltage transformer/Auto	04 Nos.
75	Coil winding m/c. (manual)	01 NO.
76	D.C./A.C.Ammeter 0-50 mA	02 Nos.
77	-do- 0-500 mA	02 Nos
78	-do- 0-1 mA	04 Nos.
79	-do- 0-5 mA	04 Nos.
80	-do- 0-100 mA	02 Nos
81	Multimeter small	20 Nos.
82	D.C./A.C. Ammeter 0-50 mA	02 Nos.
83	Multimeter Big	02 Nos.
84	Digital multimeter	02 Nos.

85	E.V.M.	02 Nos
86	Thermo-couple meter R.F. 100 mA	01 No.
87	-do- 0-500 mA	01 No.
88	D.C./A.C. Voltmeter 0-5V	04 Nos
89	-do- 0-10 V	04 Nos
90	-do- 0-50V	04 Nos.
91	-do- 0-500V	02 Nos.
92	-do- 0-5 KV	02 Nos.
93	Commercial receiver transistorized	02 Nos.
94	Watt meter 5/250 V	01 No.
95	P.A. amplifier	02 Nos.
96	Loudspeakers	16 Nos.
97	Microphone (assorted)	06 Nos.
98	Head phone earphone	04 each
99	Receiver aco real kit	02 Nos.
100	Transistors	Consumable
101	Electrical components for assemble	-do-
102	Insulation tester	02 Nos.
103	Service Oscillator	04 Nos.
104	Signal tracer	04 Nos.
105	A.F.Oscillator	04 Nos.
106	Frequency Modulator	02 Nos.
107	Output meter	02 Nos.
108	C.R.O.	06 Nos.
109	Power Supply 0-30V/DC 0-300V	02 Nos. each
110	Sweep generator with X-Y display with marker	02 Nos.
111	T.V. Camera B/W & Colour	01 each
112	A.C. Bridge	01 No.
113	Record Player	02 Nos.
114	Record changer	01 No.
115	Styles pressure gauge	01 No.
116	Tape recorder and stereotype	03 Nos.
117	T.V.Trainer	01 No.
118.	T.V. Receiver B/W (solid state)	02 Nos.
119.	T.V. Receiver coloured with latest technology	03 Nos.
120	Pattern generator B/W and colour	02 Nos each
121	Signal generator Am/Fm	04 Nos.
122	Transistor Tester	01 No.
123	I.C. Tester	01 NO.
124	Signal injector	02 Nos.
125	Distortion meter	01 No.
126	Loud speaker	02 Nos.
127	Strain gauge with load cell	02 No.
128.	V.C.P.	01 No.
129	V.C.R.	01 No
130	Micro processor training kit	01 NO.
131	Steel cabinet 120 x 60 x 45 cm	04 Nos.
132	Steel lockers with 16 drawers	02 Nos.
133	Digital I.C. Trainer	01 No.
134	Logic Probes	01 No.
135	Frequency Counter	01 No.
136	A.F./R.F. Oscillator	02 Nos.
137	Inter Com. System	01 No.

SYLLABUS FOR THE TRADE OF ELECTRONIC  
MECHANIC UNDER APPRENTICESHIP  
TRAINING 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 practical operations/skills of the two years course for the I.T.I. trainees of trade Mech. (Radio & TV) or Mechanic(general Electronic). For the remaining period i.e. in 3<sup>rd</sup> year the shop training would include the operations/skills as per the syllabus for this trade.

(The syllabus for this trade should be considered as 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 I.T.I. in the trade of Mech.(Radio & TV)/Mechanic(General Electronic) using the Tools & Equipment prescribed for these trades.

**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 I.T.I. in the trade of Mechanic (Radio & TV)/ Mechanic (General Electronic) using the Tools & Equipment prescribed for these trades.

**3. Third year**

In the third year of Apprenticeship Training, the apprentice will receive shop Floor Training with special reference to safety, manufacturing Process, general testing, and maintenance techniques of electronics components and equipments, 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 industries/establishment, which would fall in at least any one of the identified groups 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 equipments.
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 & 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) Vacuum impregnation
- ix) Bakelite and plastic moulding

### 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 and sockets
- (x) Active components
- (xi) Plated metal parts

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

(c) Use of Test Instruments such as :

- (i) Insulator Tester
- (ii) Vacuum Tube Tester
- (iii) Transistor Tester
- (iv) I.C. tester
- (v) Logic circuit Tester

### 4. **Inspection**

Step-wise and final inspection procedures and other quality control techniques.

### 5. **Maintenance**

- (a) Wiring of an electronic maintenance/test bench
- (b) Modern trouble shooting sequences & techniques for electronic equipments.
- (c) Replacement of defective components in –
  - (i) Simple electronic circuits on chasis.
  - (ii) P.C.B. circuits
  - (iii) Hybrid circuits
- (d) Care and replacement of sockets for –
  - (i) Vacuum tubes
  - (ii) Transistors
  - (iii) I.Cs.

### 5. **Transformers & Coils**

(a) Care and maintenance of the following transformers :

- (i) Power
- (ii) A.F.-Input-Driver-output
- (iii) I.F.
- (iv) R.F.
- (v) Rewinding of small transformers
- (vi) Winding of R.F. coils, deflection coils , etc.

## **MAJOR GROUPS**

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

### **Group – A Domestic Electronics**

Shop Training is assembling, aligning, testing and servicing of any one or more of the following equipment :

- (a) Radio Receiver (Tube, Transistor & Hybrid Versions)
- (b) Black and White T.V. Receiver (Tube, Transistor and Hybrid Versions)
- (c) F.A. Systems, Stereo Amplifier Systems etc,
- (d) Tape Recorder (Cassette and Spool Type).
- (e) Colour T.V. Receivers

### **Group –B Industrial Electronics**

Shop Training in assembling, aligning, testing and servicing of any one of or more of the following equipment/systems

- (a) Speed control
- (b) Photo Electric Control
- (c) Welding control and Servo control
- (d) Process control

### **Group-C Medical Electronics**

Shop Training in assembling, aligning, testing and servicing of any on or more of the following medical equipment/systems. :

- (a) E.C.G. systems
- (b) Recording Systems
- (c) Patient Monitor systems
- (d) X-Rays system
- (e) Other Medical Electronics

### **Group – D Professional Electronics**

Shop Training in assembling, aligning, testing and servicing of any one or more of the following equipment :

- (a) A.F. Signal generator, pulse generator.
- (b) R.F. Signal generator
- (c) V.T.V.M. and multimeters
- (d) C.R.O.
- (e) Power supplies and stabilizers.
- (f) Electronic desk calculators
- (g) Digital systems
- (h) Electronic exchanges.

**Group \_E**  
**Electronic Components.**

Shop Training in manufacture and testing of Electronic materials and components.

**SYLLABUS FOR RELATED INSTRUCTIONS :**

Related Instruction should be imported 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 contents of the two years training course for the I.T.I. trainees in the trade of Mechanic (Radio & T.V.) /Mechanic (General Electronic)

**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 been indicated. The hours indicated are flexible and are 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 horsepower motors and micro motors.

- (4) **Electro Mechanical/Magnetic Devices & components :**

- i. 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.
- iv. Plugs, sockets, multipin connectors, PCB connectors, R.F. & A.F. connectors, tube, transistor and I.C. sockets.

## **(5) Electronics 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, styreflex, oil filled etc. their performance ratings and applications.

**Ferrites** : Ferrite components and their applications.

**Transducers** : Types of transducers and their application in electric systems.

**Crystals** : Types of crystals and their applications.

**Insulators** : Electrical properties of ceramic, plastic bakelite, mica and other insulating materials and their applications in electronic components and systems.

### **Active Components**

Principle of operations and performance characteristics of devices such as vacuum tubes, gas tubes, photo-tubes, CRT (including picture tubes), semi-conductor diodes (zener, rectifying, detection, tunnel, switching, diodes, gunn diodes, varactor diode and photo diodes) thermistors, VDRs, silicon and Germanium transistors, FET'S UJT, DIAC'S, TRIAC'S etc. and integrated circuits.

Application of the above components in common electronic equipment. Display devices-Nixie tubes, LEDs, LCDs, etc.

## **(6) Electronic Modules**

Operating principles, 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
  - © Saw Tooth Wave
- (vi) Mixer modules
- (vii) Differentiating modules
- (viii) Integrating modules
- (ix) Logic circuit modules
- (x) Multivibrator modules

- (xi) Multiplexer modules
- (xii) Recorder modules
- (xiii) Timer modules
- (xiv) Voltage regulator modules

(7) **System Assembly**

General principles of the working and block diagrams of systems such as

- (i) Radio
- (ii) TV (Black and White )/TV(Colour)
- (iii) P.A. systems
- (iv) Tape recorders
- (v) Slide/Cine projectors
- (vi) V.T.V.M.
- (vii) C.R.O.
- (viii) Signal generators
- (ix) Pulse generators
- (x) X-Ray equipment
- (xi) Electro cardiographs
- (xii) Recording systems
- (xiii) Speed control DC motors etc.
- (xiv) Analytical instruments (Electronic)
- (xv) Communication systems.

(8) **Testing and Calibrations**

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 testing instruments/equipments for servicing electronic systems. Use of test rigs & jigs, components substitution in handling of P.C.B. circuits and hybrid circuits 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) 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 moulding
- (viii) Sheet metal work-shearing, punching
- (ix) Thread cutting-use of taps and dies.
- (x) Vacuum impregnating
- (xi) Polishing, buffing etc.



## II. Technical Calculation and Estimating

1. Review of mathematics taught in the first two years.
2. Use of Logarithmic tables for all technical calculations.
3. Trigonometry-Use of trigonometric tables, simple problems in basic trigonometry.
4. Slide Rule-Use in technical calculations.
5. Electronic Desk Calculators : Use in technical calculations.
6. **Simple calculations on**
  - (i) Rating, efficiency, etc. of small motors, transformers.
  - (ii) Rating of resistors.
  - (iii) Frequency response, amplification, biasing etc, of amplifiers.
  - (iv) Choice of rectifier, determination of rating etc.
  - (v) Simple LCR circuits, resonance and oscillators etc.
  - (vi) Coils, Q.factor, mutual inductance, etc.
7. **Estimating the cost of**
  - (i) Domestic electronic equipment
  - (ii) Professional electronic equipment
  - (iii) Industrial control equipment

## III. **Engineering Drawing**

- (i) Revision of previous two years work
- (ii) Blue print reading
- (iii) Advanced circuit diagrams, their reading and drawing
- (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 electrical and electronic components.