COURSE CURRICULUM
FOR
INSTRUMENTATION
UNDER
CENTER OF EXCELLENCE

Upgradation of ITIs into Cntres of Excellence-Broad guidelines for implementation of the Broad Based Basic Training in Instrumentation Sector.

These Centres will be providing multi skill training to meet the skill requirement of particular sector of industry with their active involvement in all aspects of training. The training will be provided in three parts as given below:

- ✓ Training in Basic skill areas for a period of one year.
- ✓ Training in Advanced modules for next six months.
- ✓ The testing & certification for the Basic skill training during first year & also for advanced training during next six months will be conducted by NCVT.
- ✓ Training in specialized modules mainly in the industry (The course curricula, duration etc will be designed in consultations with the IMC/local industry. The trade testing & certification for this component will be done jointly by the State Government & Industry. Said certificate will be recognized by NCVT

As per the recommendations of the EFC, Training in the shop floor should constitute 25-40% of the curriculum.

The training programme will have multi-entry and multi-exit provisions:

- ✓ trainee can opt to go to the labour market after completing broad based basic training of one year duration as well as after completing 1½ year of training.
- ✓ trainee can join training after some time for advanced/specialized training in another module of same sector .
- ✓ ITI pass out trainee of the particular trade(s) from the conventional system can seek admission for advanced/specialized training in relevant sector .

In first year, curricula in the Area/Sector of 'Instrumentation ', uniform rotation for eight weeks each in the Basic Modules as mentioned below will be taken up. The trades from where existing infrastructure i.e. equipment/ instructor etc could be utilized for the training in 'Instrumentation 'sector is given below:

Basic modules	Name of the Module	Trade(s) from where existing infrastructure /equipment/ instructor could be utilized
IBT-01	*BASIC ENGINEERING SKILL-1	*
IBT- 02	BASIC ENGINEERING SKILL-II	Machinist
IBT- 03	BASIC ELECTRICITY & ELECTRICAL INSTRUMENTAION	Electrician
IBT- 04	BASIC ELECTRONICS & ELECTRONICS INSTRUMENTAION	Electronic Mechanic
IBT- 05	MESURMENT & MEASURING INSTRUMENTS	Instrument Mechanic
IBT- 06	BASIC COMPUTER SKILL	COPA /IT&ESM

* Facilities available in ITIs for trades viz Carpentry, Fitting ,Sheet Metal Shop, Plumbing & Welding may be utilized for imparting skill training of one to two weeks duration by adjusting the timings Where a particular trade/trades is/are not in operation , limited facilities required for imparting basic skill be created .

For these modules, Trade Practical will be 28 hours /week and Trade theory for 4 hours /week. Apart from above Generic modules as mentioned below will be taught throughout the year.

IBT-07- WORKSHOP CALCULATION & SCIENCE……..2 hrs/week

IBT-08-ENGINEERING DRAWING ……2hrs/week

G-01-ENTERPRENEURSHIP AND COMMUNICATION SKILLS….. 2hrs/week

In addition, 4 hours/week have been kept for Library studies & Physical Training

Vocational Instructors:

NAME OF THE MODULE	No. of Vocational Instructors (VIs)
IBT – 01 to 06	Six VIs one each for 6 module of relevant trades
IBT-07 & ITBT - 08	One VI having Diploma in relevant field
G-01	One contract/part time / guest faculty for Generic module, ENTERPRENEURSHIP AND COMMUNICATION SKILLS

The eligibility and other criteria will be as follows:

Eligibility : 10th pass under 10+2 system with Science

Batch size : 96 trainees 16 in each module (20% supernumeraries be allowed to take care of drop outs as already exist under CTS)

Admission:

For basic training, admissions are to be made in August / Feb each year.

Fee Structure:

Fee Structure may be decided by States Govt. in consultation with IMCs . It may be desirable to prescribe a uniform tuition fee for a sector in all Centres of Excellence of a state .

Space: Since workshop/theory class rooms are envisaged to be accommodated in the existing building of the ITI, therefore, following norms are prescribed only for new infrastructure is to be created .

(1) Workshop space of min 70 sqm for each basic module (except for IBT- 1 where existing workshop of related trades are being used)
(2) Three Theory classrooms of 30 sqm each.

The Theory classrooms should have latest infrastructure including AV aids as per details given below:

1.	Suitable Chairs/ tables*	-	As required
2.	OHP/Epidiascope	-	1 No.
3.	Laptop computer/PC (latest) & LCD projector**	-	1 No.
4.	Magnetic white board	-	1 No.
5.	White board	-	1 No.
6.	Flip chart	-	1 No.
7.	Storage Almirah	-	As required

(* Optimum utilization of space/flexibility may be kept in view)

(Keeping in view the constraints of funds under the scheme, it is proposed to procure only one set of Laptop computer/PC / LCD projector for CoE. However, States may procure additional Laptop computer/PC/LCD projector from their funds) While selecting furniture, it should be kept in mind that these are meant for Centres of Excellence. Criteria like maximum flexibility/utilization of space should be kept in view.**

Office Equipment:

For each CoE one Scanner, one Photocopy Machine and one PC/printer along with suitable accessories/furniture and internet connection (if not already available in the institute) is proposed to be provided for each CoE, in addition to the equipment prescribed in the syllabus.

Addition/alteration/Construction:

For Civil Works, tentative amount of Rs 40.00 lakhs have been proposed per CoE. It is envisaged to have separate block/ wing for the Cenres of Excellence in the ITI campus. In case space is available in the existing building of an ITI for taking up new areas as per requirement of the cluster of Industry, the existing space will be renovated as per the need. Alternately, separate block will be built up in the same campus keeping in view the space requirements of the Electrical Sector.

While planning for addition /alteration/Construction of workshop and Class rooms, following may be kept in view:

- ✓ concept of a Centre of Excellence
- ✓ the fact that the requirement of funds for construction /addition /alteration for advanced training will be higher than that of basic training

Publicity

Wide publicity & advertisement be given for better response . The role of the local as well as the concerned Industry is very vital for the success of this program.

States may consider providing additional equipment/ other facilities like separate Library/upgradation of existing Library, Conference Hall/ Committee Room etc. from their own funds.

THE FOLLOWING MEMBERS ATTENDED THE WORKSHOP HELD FROM 18TH TO 20TH APRIL, 2005 IN THE COMMITTEE ROOM OF A.T.I.-E.P.I., RAMANTHAPUR, HYDERABAD, FOR DEVELOPING THE CURRICULA IN THE TRADE OF CRAFTSMEN INSTRUMENTATION TO BE INTRODUCED IN EXISTING INDUSTRIAL TRAINING INSTITUTES ALL OVER INDIA AND TO MAKE IT INTO "CENTRE OF EXCELLENCE"

No.	Name of the Member with designation S/SHRI	Name of the Organization/ Industry	Capacity
1.	Ashok Kumar, Director	ATI-EPI, Green Park, Niranjanpur, Dehradun-248 171.	Chairman
2.	H. Somasundaram, Director	ATI-EPI, Ramanthapur, Hyderabad-500 013.	Member
3.	Sri A.S. Kesai, Regional Director,	Regional Director of App. Training (Western Region), A.T.I., Campus, V.N. Purav Marg, Sion, Mumbai-400 022.	Special Invitee
4.	Sri R.L. Singh, Jt. Director	ATI-EPI, Ramanthapur, Hyderabad-500 013.	Member
5.	R.E.C. Johnson, Tech. Officer	C.C.M.B., Habsiguda, Hyderabad-500 007.	Member
6.	K.S. Hebbar, **(Representing: Electronic Industries Association of Andhra Pradesh)** I.E.T.E., Centre, O.U. Campus, Hyderabad-500 007.	Chief Executive, Electro Magnetic Devices, Sai Ratna Complex, ECIL Cross Roads, Kushaiguda, Hyderabad-700 06	Member
7.	V.K. Rao, Advisor	Electro Magnetic Devices, Sai Ratna Complex, ECIL Cross Roads, Kushaiguda, Hyderabad-700 062.	Member
8.	Sanjay Mahagoankar,	Hindustan Fluoro Carbon, Ltd., Basheerbagh, Hyderabad.	Member
9.	D. Bhanu Murthy, Scientist 'F'	D.L.R.L., Chandrayangutta Lines, Hyderabad-500 005.	Member
10.	I. Meher Prasad, Jr. Manager	Dr. Reddy's Research Foundation, V.V. Nagar Colony, Hyderabad-72.	Member
11.	Dr. R. Subramanian, Dy. Director	National Institute of Nutrition, Tarnaka, Hyderabad-500 007.	Member
12.	A.K. Somani, Scientific Officer (Instrumentation)	N.F.C., Cherlapalli, Hyderabad-72.	Member

13.	E.V. Suryanarayana, Sr. Manager (Instrumentation)	MIDHANI, Kanchanbagh, Hyderabad.	Member
14,	Narinder Singh,	Industrial Training Institute, Ambala City, Haryana.	Member
15.	Narender Kumar, Dy. Director (Tech)	Industrial Training & Vocational Education, Haryana, 30 Bays Building, Sector-17, Chandigarh-160017.	Member
16.	S.A.H. Khan, DGM. (Instrumentation)	Sanghi Polyesters Ltd., Sanghi Nagar, Ranga Reddy District, Andhra Pradsesh-501 511.	Member
17.	V.M. Rao, Director	A.T.I., Vidyanagar, Hyderabad-500 007.	Member
18.	P.K. Srivastava, Asst. Director of Trg.	A.T.I., Vidyanagar, Hyderabad-500 007.	Member
19.	S. Chatterjee, Jt. Director	ATI-EPI, Ramanthapur, Hyderabad-500 013.	Special Invitee
20.	A.K. Mishra, Dy. Director	ATI-EPI, Ramanthapur, Hyderabad-500 013.	Special Invitee
21.	R.B.Sreenivasa Naik, Dy. Director	ATI-EPI, Ramanthapur, Hyderabad-500 013.	Special Invitee
22.	T.V.L.Narasimha Rao, Dy. Director	ATI-EPI, Ramanthapur, Hyderabad-500 013.	Special Invitee
23.	C.S. Murthy, Dy. Director	ATI-EPI, Ramanthapur, Hyderabad-500 013.	Special Invitee
24.	V. Subramanyam, Asst. Director of Trg.	ATI-EPI, Ramanthapur, Hyderabad-500 013.	Special Invitee
25.	N. Ramesh Babu, Asst. Director of Trg.	ATI-EPI, Ramanthapur, Hyderabad-500 013.	Special Invitee
26.	M. Sudhendra, Training Officer	ATI-EPI, Ramanthapur, Hyderabad-500 013.	Special Invitee

The above panel of members designed and approved the syllabus for the first year module consisting of 48 weeks and advance training as specialization module in area of choice during second year of six months duration each.

UP-GRADATION OF ITIs INTO CENTERS OF EXCELLENCE (COE)

Modules of Broad Based Basic Training

IBT- 01 BASIC ENGINEERING SKILL-1

IBT- 02 BASIC ENGINEERING SKILL-II

IBT- 03 BASIC ELECTRICITY & ELECTRICAL INSTRUMENTAION

IBT- 04 BASIC ELECTRONICS & ELECTRONICS INSTRUMENTAION

IBT- 05 MESURMENT & MEASURING INSTRUMENTS

IBT- 06 BASIC COMPUTER SKILL

IBT- 07 WORKSHOP & CALCULATION

IBT- 08 ENGGINEERING DRAWING

IBT- 09 COMMUNICATION, GENERAL AWARENESS & ENTERPRENEURSHIP SKILL

First year
Basic Modules of one year duration

MODULE : IBT – 01 BASIC ENGGINNERING SKILL- I
DURATION : 8 WEEKS

Week No.	THEORY	PRACTICAL
1	Introduction to Institution, Vocations trade running in the Institute, Introduction to the Scheme of Excellency, Sector Instrumentation, Its Knowledge and scope of employability. Measuring Units & System of Units, MKS, & SI Unit System, Concept of Least Count	Visit to Institute, Visit to Manufacturing / Deep Implementation/Application Industry involved in the Field of Instrumentation. Practice of Use of General Instrument used for measuring Mass/ Weight, Length, & Time, Vernier caliper, Micro meter, Speedometer, Vernier Height Gauge (All mechanical & Digital
2 - 3	**CARPENTRY** Hand tools Used in carpentry shop its use & safety rule while use and preventive maintenance. Knowledge to wooden fabrication methods, Their principle and Safety rules Nomenclature and Working Introduction & Application of Machine & Machine Tools Used in wooden , Fabrication & Manufacturing Process Making Drawing, and dimensioning of a gazette, making list of material required with their specification and quantity. Introduction to paints & polish material and preparation of surfaces for above.	Practice of use of Hand Tool used in Carpentry Shop such as Carpentry Push Saw, carpentry pull saw, Tendon Saw, Key hole Saw, Planes, Chisels, Mallets, Hammer, Marking, Dividing & Holding Tools & vices Cutting, Chipping, planning practice and Making of Carpentry Joints such as Lap Joint, Dovetail Joint (Using saw , plane, Firmer Chisel etc) Planning, Grooving, Drilling and Turning of wood, practice on wood using lathe & drill other machine. (or Visit to a wooden furniture manufacturing Industry) **Fabrication of a small wooden gazette.** **Finishing, making surface for painting & polishing, Polishing of above cabinet from outside & painting from inside.**
4 - 5	***FITTING SHOP*** Hand tools. Their types, characteristics, Use, Do's & Don's, specification and sizes, Like Files, Calipers, scribers, Vices, Scale, Gauges, Hammers, Pliers, Screw Drivers, Chisels & punches, Hacksaw, Selection of Hacksaw Blades, Various types of Spanners, L & N Keys, Screw drivers etc Introduction to Drilling Machine, types of Drilling Machine, Drill bits & reamers, their	Practice of use of Hand Tool used in fitting Shop such as Hacksaw, Chisels, Files Hammer, Marking , Dividing & Holding Tools & vices, Linear Scale, Tri square, Vernier Caliper, Micrometer, Height Gauge, slip gauge, thread ring/plug gauges, Bevel Protector, Spanners, L & N Keys, Screw drivers , Hacksaws etc Sawing, Chipping, Filling on given MS block according to given size & drawing Practice of Drilling, Chamfering & Tapping on MS block using Drill Machine & Hand Tap & Die set Dismantling and assembling practice. **Making of a square punching die for sheet punching**

	description, size, types & use , Taps & Dies, Care to be taken while Drilling and use Taps & Dies.	
6	**SHEET METAL SHOP** Essential tools used for sheet metal, Sheet metal operations, measuring, Layout marking, shearing, punching, blanking, piercing, Forming, Bending and Joining Advantages and limitations of sheet metal work at cold process, Brief concept of Hot Process & Operations with machines , Concept of joining of sheets by solder, Flux, soldering, brazing and welding.	Practice of use of Hand Tool used in sheet metal Shop such as Snip , Square & V Blocks, Chisels, Files Hammer, Marking, Dividing & Holding Tools, sheet & wire gauges Cutting, Bending of Iron Sheet as per development drawing of given object Making of various kinds of joints on the Metal Sheet, Riveting Practice and soldering, brazing practice on joint of sheets. **Making of panel or cabinet or Chassis for and as per given drawing.**
7 - 8	PLUMBING, WELDING Study & use of Hand Tool used in plumbing shop such as pipe vice, threading die, pipe wrench, Introduction to welding, OXY-ACETYLENE welding material & Equipment, Resistance Welding, Arc Welding machine, and composition of welding electrodes, Brief Idea about TIG & MIG Welding Principle of electrolysis, Electrolyte solutions, electrodes, Electrolysis bath tub, Luster, Buffing balls, concept of thickness and quantity of electroplating	Cutting of conduit pipe, GI pipe Bending of conduit pipe Threading of GI & Conduit Pipe and making of joints using elbows and sockets. Welding on conduit pipe joint. Conduit pipe & Sheet **Making of useable gazette using pipe and MS sheet** Demo on complete procedure of electroplating process. Practice of Surfacing, Buffing, Nickel Chromium, Gold/Silver Electroplating. **Electroplating the gazette made or any hand tool**

MODULE : IBT – 02 BASIC ENGINEERING SKILL – II
DURATION : 8 WEEKS

Week No.	THEORY	PRACTICAL
1	**MACHINING** Lathe Machine, Its Accessories and attachments, types of chucks, lathe center and study	Identifying of parts & understanding of working application of lathe machine and Instrument Lathe machine
2	Various Lathe operations: speed, feed, and depth of cut, types of cutting tools. Cutting angles.	Practice clamping of job, centering it, setting of turning tool, Plane, step and taper turning practice on lathe and instrument lathe machine/Instrument Lathe machine
3	Threading & Knurling tools and their method to use. Working of Shaper Machine and its application, Dos & Don'ts	Grooving, Drilling, Boring, Threading, Knurling practice on lathe. Practice of making various different shaped MS jobs using Shaper machine
4	Various milling machine operation type of cutters types of milling machine.	Practice on use of various of cutters on milling machine, Straddle milling, gang milling, climb and conventional milling, helical milling, Indexing and gear cutting on milling machine,
5	Working principle & operation of surface grinder and cylindrical grinder.	All Grinding operation for Surface grinding, cylindrical grinding and adverse grinding, grinding of tools and cutters
6	**Basic concept & operation on** CNC TECHNOLOGY, NC, CNC, DNC, CAD-CAM, FMS, CIM as a system working programming, Co-ordinate system, address command G and M modes, standard and canned cycles, Programming Examples Importance of CNC machine over main production process. Construction detail of CNC mechanism Etc. CNC drivers, servo motors encoders (Absolute and incremental) liner& rotary motion system (LMS&RMS), Techno generators, revolvers.	*Demonstration of CNC m\c special constructional and operating feature with reference to driving mechanism, machine tool. Example the use of computer as CNC workstation. Communication between hardware and software. Familiarization with co ordinates system. Demo and explanation of CNC machine feature such as- 1. Axis driving element, servo motor, gear box, ball screw, position feedback, open loop. 2. Maintenance card, history card and recording the data. Reading and analyzing of CNC alarm message during machine operation. 3. Mounting of rotary encoder and linear optical scale on the axis. 4. Accuracy and performing of CNC machine, problem and remedies.

		5. Inaccuracies such as backlash, repeatability, counter balances systems mechanism. *(To be carried out at industry as Institute may not own any CNC machine but CNC trainer can be purchased.)
7	Introduction to die casting, gravity die casting, main parts of casting machine, main parts of die, parting line runners, gates, vents, ejectors, cores, shrinking, cooling method, location, die materials, casting materials.	Visit to Industry to study various casting processes Practice on operations for bending & cutting using bending & cutting Dies Workbench training on assembly of press tools, moulds, Jig & Fixture
8	Plastic Technology Source and chemical molecular structure of plastic material, monomers, polymers, co polymers, thermoplastic and thermo settings, amorphous and crystalline plastics, plastic processing techniques,, post processing treatments. Moulds: Injunction moulds and molding, Main parts, runner, gates, parting lines, ejection, ejectors, return mechanism, undercuts,, sliders,, splits and moulds,, molding of threaded components, mould cooling,, three plate moulds, tool location and guide system, ventilation in moulds	Practice on various operation of plastic molding machine Practice on making various kinds of moulds, machining of moulds, matching of bearing faces, adjustments of sliders, polishing of moulds Practice on Plastic processing techniques, observe & control behavior of plastic during hot processing, Post processing treatments & Precautions

MODULE : IBT – 03 BASIC ELECTRICITY & ELECTRICAL INSTRUMENTATON

DURATION : 8 WEEKS

Week No.	THEORY	PRACTICAL
1- 2	Safety Precaution and first aid, Care & Maintenance of hand tools. Basic atomic structure Electro emission classification of materials e.g. Conductors, semi-conductors and Insulator Types, grade and sizes of insulated wires and cables, their proper selection and use. Introduction to Hand tools their use, operation and safety precautions Different types of solders fluxes and their proper use. Introduction to the equipments used for soldering and crimping, care & maintenance on Soldering & Crimping equipments, Specification to common electrical accessories , Letters sign and symbols used in electrical technology Electrical accessories used in house / Lab/ workshop wiring, their Specification. Wiring concept , simple house wiring circuits, Stair case, godown wiring Ckts, Brief Idea about control panel wiring, Main Board wiring, Use of Fuses, cutouts, Miniature Ckt Breakers	Basics of electricity, electrical shock, Electrical safety, Familiarization with the safety tools and equipments. Demonstration of safety equipments. Identifications various kinds of insulated & non insulated and enameled Wires, Practice on use Do's & Don'ts with hand tools used in Electrical Labs, Like Line Tester, Screw drivers, Electrical Knife, Holding Pliers, Cutting pliers, Insulation Nippers, Saws, Chisel, Hand Drilling Machine Practice of Making Different types of joints e.g. Britannia, Straight, Tee, Western union. Care in making a good joint on copper aluminum wires and cables. Practice of Crimping and Clamping of thimbles & Connectors. Practice of Soldering of Electric joints. Practice of Making of Simple House wiring Circuits, Controlling of one & more Points from Single and multiple places Making of Series testing & multiple socket extension board .

3	Electrolysis and laws of electrolysis, primary and secondary cell, construction and working of dry cell , standard cell, lead acid battery, Ni-Cd battery, Alkaline batteries , common defects in cells and batteries and their remedies, care and preventive maintenance. Ohm's law and its application, concept of series , parallel and mixed circuits, identification of AC and DC meters, Resistance, Specific Resistance, Conductivity and Resistively, laws of resistance, Kickoff's law and their application, Wheatstone bridge, types of resistances and concept of resistance color code	Effective usage of measuring equipments like current and voltage meters of DC supply measure of resistance millimeters. Grouping of Cells in series & Parallel Identification of various kinds of cells & batteries Lead acid batteries, its care and maintenance Making of Circuit connection for verification of ohm' law Making of connections for various grouping of Resistances measurement of separate, grouped & cumulative Resistance, Current, & Voltage in the mash Practice on use of equipments made on principle of Wheatstone bridge
4	Magnets , their types , shapes , properties, method of magnetization and demagnetization, terms and their definition used in magnetism, classification of materials into paramagnetic and diamagnetic group, electromagnets and their advantage on permanent magnet, various laws applied in electro-magnetism, field around current carrying conductors and loops, construction and principles of working of solenoids, Electromagnetic Induction, types of induction, Faraday's law, Lenz's law, ampere rule, eddy current, Alternating current(AC) , RMS value, Max value , Average Value , Inductance , Capacitance , Reactance Impedance, Power Factor, Form Factor , Crest Factor , Ac generation sources and methods, Brief concept of 3 phase AC Supply also.	Tracing the Field of Bar magnet, Horse Shoe magnet, finding of magnetic strength, Tracing the Field Combined effect of two magnet with same & opposite polarity, Tracing the magnet field set up by a current carrying conductor, and a loop, Making of simple electro magnet, measuring of its field strength & tracing of magnetic field Finding the permeability of iron, making of a electromagnetic over load relay Measure AC quantities like voltage, current. Measurement of frequency. Measure AC power & power-factor. Measure electrical power (single-phase and 3-phase) power and energy. Energy meter, watt-hour meter. power (single-phase and 3-phase) power and energy. Energy meter, watt-hour meter.

5	Application of electromagnetic induction, Transformer principle , construction and working of Transformer, classification and types of transformer, Mathematical terms and formulas used in transformer, Principle of working of instrument transformer (CT, VT) Electrical measurement: Introduction to instrument, absolute and secondary instrument, Analog and Digital Instrument, Indicating Instrument, operating forces, construction and details ,types of support & balancing , torque weight ratio, control system, comparison between spring and gravity control, damping system and types of damping, damping torque of metal disc, pointers and scale , symbol used for analog instruments-nature of measured quantities and number of measuring elements, safety, accuracy class, principle of operation, Recording Instrument, Integrating Instrument, pointer and scale , concept of accuracy and error.	Preparation of former for different types of coils and tapping, practice on that Making of bobbins, cutting of laminations lining by leatheroide paper and cloth etc. Winding of step down Transformer 1. Demonstration of Large size Cut Model of Basic Instrument & study of Basic forces and effect utilized Basic force acting on indicating instrument and effects utilized in different types of instruments. 2. Demonstration of Dismantling, showing of each part of basic Instruments and re assembling, 3. Dismantling Assembling, Repairing of moving parts of instruments-, Fault finding, replacement of parts and adjustments.
6 - 7	Principle and construction working of Galvanometers, Types of galvanometer and their construction, working, analog Ammeters, Voltmeter and Ohmmeter , , construction , working of PMMC type instrument, Ammeter Shunt, sensitivity of PMMC instrument, conversion of PMMC into Voltmeter, series and shunt type ohmmeter, multi VOM meter Principle, construction, working of moving iron instrument. Classification of moving iron instrument, concept of shunt and multiplier for moving iron instrument, comparison of Attraction and Repulsion type	1. Seeing of, construction and operation of Permanente magnet moving coil instruments. 2. Seeing of, construction and operation of various types of Galvanometers. 3. Dismantling Assembling, Repairing of moving coil instrument Fault finding replacing of paste and adjustments. 4. Calibration of Moving Coil, instruments**,** Methods of calibration, preparation of error cards and designing of simple testers. 5. Voltmeters and multi-voltmeters, how the current meter is converted into voltmeter-calculation of series resistance and use of multipliers for extension of voltmeter range. 6 Extension of ammeter range, purpose and calculation shunt, method and precaution while connecting shunts. 7Moving Iron instruments, purpose, construction and operation of moving iron

	instrument, errors , advantage and disadvantage of moving iron instrument Construction , working , error advantage and disadvantage of Electrodynamometer instrument, electrodynamometer type wattmeter, Thermocouple Wattmeter, Hall effect, construction, Motor type meters, Energy meter	instruments. 8 Galvanometer, Description about various types of Galvanometers. 9 Ohmmeter principle of series, shunt and potentiometer, ohmmeter (Method of converting current meter into meters) 10 VOM, Working principle, method of use volt-ohm , milli ampere meter 11 Dynamometer Instrument, Principle, connection and operation of dynamometer instruments. 12 Hot wire instrument, principle, purpose and construction of hot wire instruments. Thermocouple and rectifier type instrument, principles, purpose, construction and operation of thermocouple and rectifier type instruments. 13 Suppressed zero and long scale instruments 14 Meggers principle, construction and operation of meggers, measurement of earth to line resistance using megger 15 Construction of Kilowatt hour meter. Connect and operate kilo watt hour meter, 16 Construction of Latest Pilferage free KWH meter
8	Single phase motor:- Principle Construction and working of Single phase Induction motors, Types, construction working of single phase motor , capacitor motors, universal motors, shaded pole motors & repulsion motor, their characteristics , advantage, care and maintenance, fault and remedies Winding:-Insulating material used in winding, classifications characteristics, types of varnish, methods of impregnation, terminology in motor winding procedure and important points. Types of coils used in motor winding types of ac winding DC motor construction and types, winding single layer and double layer winding calculation and preparation of winding data testing. Micro motors, stepper motors, DC motor	Familiarization with parts construction of capacitor start induction run, capacitor start capacitor run split phase induction run, repulsion start induction run motor repulsion start repulsion run motors and run the motors. Trace out the circuit diagram carry out the insulation test repair and, maintenance of single phase motors Dismantling of burnt single Phase Electric motor, Overhauling of the parts and Rewinding of the Burnt motor, use of Insulation Paper, varnishing of winding, Reassembling, Alignment of armature.

MODULE: IBT - 04 BASIC ELECTRONIC & ELECTRONICS INSTRUMENTATION
DURATION : 8 WEEKS

Week No.	THEORY	PRACTICAL
1	Introduction to hand tools, familiarization with basic measuring instruments, soldering, Basic atomic structure, concept of conductor, insulator and semiconductor. Identification, specification, testing, use and application of various kind of general use electrical and electronic Components and their terminals, like resistances, & capacitors, Measurement by colour code, switches, relays, miniature and micro switches, reed switches & latches, sockets – connectors & plugs, fuses, terminals, tags, legs & thimbles, Relays, ELCBs, MCBs, Fixed & Variable resistors, Thermister, LDR, VDR, characteristics, And application, Electro-magnetic, Switches, relays their Construction and working, RC time Constant and Fixed variable capacitors,	Identification of hand tools, Safety Precautions while working in Electronics Lab & Electric Shock Firs Aid, and various measuring instruments, soldering- de-soldering Practice on wire, chassis and on PCB. • Identification specification & testing of various kind of resistances, & capacitors, Measurement by colour code • Familiarize with various types of switches. • Construct circuit with SPST, SPDT, and DPDT switches. • Familiarize miniature and micro switches, reed switches & latches, sockets – connectors & plugs, fuses, terminals, tags, legs & thimbles, Relays and their contacts, • Familiarization with various types of variable resistors, the mister, LDR, VDR. • RC time. Constant
2	PN junction diode, Forward and reverse, biasing PNP & NPN Junction Basic Construction & Working of Transistors, Transistor as Amplifier & Transistor as Oscillator, Different type of transistor, Biasing, , Concept of Half wave, Full wave & Bridge type Rectifiers & Filters, Voltage regulator. Zener regulator series regulator, variable power supplier Ices used to voltage regulators Transistor as an amplifier, CE, CB, CC configuration, Different type of power amplifier calculating	• Forward and reverse characteristics of P N junction diode & Zener Diode. • Plotting of various characteristics of Transistor • Biasing method of Transistors • Identification, Specification testing of Junction Diode & Transistors, LED, Zener Diode • Fabrication and assembly of Full wave rectifier Ckt using Diodes, Adding to Pie Filter, • Adding to Series Regulated Ckt using Zener & Series Transistor, • Build of voltage Divider , Doublers

	power amplifier calculating efficiency and different parameters for class AB and Push pull amplifier positive and negative complimentary Symmetry class Amplifier positive and negative feedback voltage and current feedback, cascading of amplifiers.	
3	Oscillators, basic oscillator, tank circuit, damped and un-damped oscillations, Construction & Working of Oscillator,, Multi vibrators mono stable, bi-stable and Astable multi-vibrator, its working, bi-stable multi-vibrator with two inputs and two outputs, voltage controlled inverter, their working principle and circuit functions, SMPS UPS converters and their applications. FET principle and working, JFET construction characteristics and Parameters, CMOS, MOSFET Working principle, construction.	• Assemble and observe the outputs of mono stable, bi stable and A-stable multi vibrators using transistors and 1C555. • Assembles and observe the output of two input, two output bi stable multi-vibrator, . • Assemble Astable multi-vibrator as a VCO. • Construct and measure the output of simple inverter, SMPS.& UPS • Characteristics of transistor As switch identification and Testing of FET, • Common Source and common drain Configuration, • Study of switching action of JFET CMOS BMOS & MOSFET. • Construct and measure the output of MOSFET based inverter, SMPS.& UPS
4	Thyristers, SCR its construction and characteristics, SCR forward and reverse bias, various firing methods, SCR gate firing circuit, SCR in AC circuit and natural commutation and forces commutation phase control action of SCR RC firing circuit, UJT its characteristics stand of ratio, UJT relaxation oscillator. UJT firing circuit pedestal and ramp circuit temperature controller, SCR with inductive load di/dt characteristics. SCR protection circuit DIAC characteristics, DC and AC pulse generators TRIAC construction and characteristic and power control circuit light dimmer fan DC motor speed control using SCR, flux control, armature current control, AC motor speed control systems.	• Testing of SCR by multi meter plot the forward characteristics of a SCR • Find the latching current and holding current of SCR, • AC switching circuit by UJT, plot the Characteristics of UJT, Construct and observe outputs of UJT firing circuit, light dimmer circuit, • Characteristics of DIAC, DIAC as a DC pulse generator, characteristics of TRIAC fan regulated • DC motor speed control method and armature current control method, SCR trainer kit.

	Demonstrating the different type of ICs.	
5	**Familiarization & basic concepts of Digital Electronics.** Digital and analog Signals, basic logic functions, basic logic gates, number system, combination, logic gate NOR, NAND, XOR, XNOR, truth tables timing diagram, excess three code, gray code, BCD code, ASCII code. Flip-Flop:- RS flip-flops, clocked RS with preset, clear inputs d,. JK, T,MSJK flip-flops, timing diagrams, series shift register, bidirectional, parallel, series in parallel out, parallel in series out registers, converters and parallel to series converter. Counter ripples, counter up timing diagram frequency divides, down counter up, counter, decade counter, ring counter and Johnson's counter.	Integrated Circuits: - Formation of diode, transistor, Resistor and constructional details- Different types of ICs. Assemble and verify truth table of OR, AND, NOT gate using discrete components. Verify truth table of NAND, NOR, XOR and XNOR gates. Study the inter conversion of gates by combination of another logic ckts Making of Min and Max Combination ckt using logic gate Study of Digital Logic Lab and perform various experiments of Flip Flops, Registers, and Counters.
6	Display devices, LED display, seven segment display, Nixie tube, LCD display, display drives, Dot matrix display format, monitors, 4 digit BCD counter with display multiplexing and de-multiplexing D/A converter, resistive network, binary ladder, comparator, A/D converter, counter type conversion and continuous type conversion, applications of A/D and D/A converter. Memory, programmable switch concept and and type of primary, ROM, RAM, PROM, EPROM and EAPROM concept of cache SIMM, SDRAM, SGRAM, VRAM etc.	• Familiarization with common anode, cathode and seven segments, LED display, LCD display and display drivers, • Construct and observe output of resistive network and binary ladder. • D/A converter, observe the output of comparator with different inputs, • Familiarize with A/D converter • Familiarize with memory ICs, parallel expansion of memory ICs, EPROM ICs, EPROM programmer.
7	Introduction of AC bridges and measurement of LC & R, study working and principle and operation method of LCR Bridge, Digital LC & R meter	Measurement of LC & R, using LCR Bridge, Digital LC & R meter

	Concept of voltage, current measurement, high input impedance meters,	Measurement of AC, DC voltage, current using all types of Analog and digital meters, ramp type, Integrating type, Continuous Balance type Study complete method of use of digital millimeter for its complete measurement provision like V,I,R, db, Temperature, capacitance, feature of testing of semiconductors, Frequency, feature of hold and memory provision
8	Block & schematic diagram Digital Frequency meter/Counter Block & schematic diagram of CRO, purpose and use of various knobs, controls & terminals on front panel, Block & schematic diagram of Function/ Pulse Generators, its , purpose and use of various knobs, controls & terminals.	Use of Analog and Digital Frequency meter/Counter , Various Type of Timer, Timers and controllers Familiarization with operation, use & application of CRO in detail .Measurement of Freq., Voltage, Phase & Phase Difference using Single, Dual Trace, Storage Type Oscilloscope. Seeing and comparative analysis of wave shape using Oscilloscope. Plotting of Lissagus Pattern Familiarization with operation and use of various kind of signal generator, function generator, pulse generator.

MODULE : IBT – 05 MEASUREMENT & MEASURING INSTRUMENTS.
DURATION : 8 WEEKS

Week No.	THEORY	PRACTICAL
1	**System of Units and Basic Measurement :** **Fundamental & Derived Units**, Length, mass, Time & temperature Measurement, Accuracy & Precision of Measuring Instruments, Error in Measurements, Significant Figures, Revision of definition of physical quantities and their mathematical relation to other quantities, Dimensions of Physical quantities, Dimensional analysis and its applications, their SI units, **Theory of errors**: Accuracy & Precision, Repeatability & reproductability, Limits of Errors, Systematic & Random error, Gaussian error analysis, combination of errors, sensitivity, threshold, drift	Practice on use of vernier caliper To find volume of solid cylinder and hollow cylinder using a venire caliper To find the thickness of wire using a screw gauge. To determine the thickness of curved glass strip and radius of curvature of a concave surface using a speedometer Measurement Practice and use of Protractors, Sine bar, Counting squares, Simpson's rule Practice, use of physical & Chemical balance Practice use of Stop watch.
2	**Velocity Measurement** : Measurement of Linear velocity,, mechanical tachometer, Electrical tachometer, stroboscope and stroboscopic method of instruments of angular velocity, Measurement of Vibrations, Accelerometer and their types	1.Construction, Purpose, working , method of use operation and testing of centrifugal and drag cup tachometers 2. Construction, Purpose, working ,method of use and function of stroboscope 3. Construction, Purpose, working Speedometer; operation and testing of mechanical and electrical , Electronic speedometer
3	**<u>Pressure Measurement</u>:-** What is pressure, Theory of Pressure: What's pressure, absolute pressure, atmospheric pressure, differential pressure, elastic pressure, pressure unit, Bourdon tube pressure gauge its principle construction , working and operation, Spiral & helical bourdon tube pressure gauge, force balance pressure gauge, Piston type, bell type and ring type pressure gauge, Diaphragm and capsule type pressure.. Working principle and construction including dead weight tester. Electrical pressure transducers, potentiometer pressure transacted capacitive pressure	Manometers construction and working Bourdon tube pressure gauge its principle construction , working and operation Recondition Bourdon tube pressure gauge. Disassemble pressure regulator. Study, repair, and adjust barometer recorder. Diaphragm and capsule type pressure.. Working principle and construction including dead weight tester.

	transducer, piezo-electric transducers different pressure transducers.	
4 - 5	**Specific Gravity & Viscosity**: Definition of density, specific gravity, Hydrometers density of gases meriting orifices, impulse wheel method, specific gravity system & instrument, turbulent flow viscosity, density and velocity Reynolds number and Bernoulli's theorem. **Flow**: Introduction to flow Theory of flow, description about, stream flow, measurement of pH and conductivity, flow measuring techniques, and flow measurement methods, variable head flow meters, Differential pressure flow meter, Orifice plates, Ventura Tubes, Flow nozzles, Pitot tubes, and Rota meters. Electromagnetic and ultrasonic flow meters, Vortex flow meters, Mass flow type meters. Shunt flow meters. **Level**: Float type, Displacement type, Hydrostatic type, Diaphragm type, Differential pressure method, Electrical conductivity method, Capacitance level, Ultrasonic and nucleonic gauges, Capacitance Probes, Solid level detectors. Air type level measuring instrument Working principles and construction Displacement and capacitor type level instruments Description and use of "U" tube monometer well type and inclined.	To find Density & specific gravity using Science lab apparatus, Practically Study construction, working principle & use of hydro meters and measurement of density To find the surface tension of a liquid by capillary rise method Simple tank type and reciprocating piston type flow meter Practice of use of oscillating type piston type flow meter Practice of use and operation of rotating van type flow meter, venturi tube flow meter, Pivot tube flow meter, Liquid seal type flow meter. Test the flow of air without Rota meter.. Making of orifice plats and flange for orifice plate. Threading of the pipes, Making of the nipple and connect the orifice assembly, and find the characteristics of orifice. Operate, connect and test fuel level gauge. Operate water manometer and check draft recorder. Maintenance of monometer. How to clean mercury and glass tubes.
6	**Thermal & Temperature** Temp, Scales, resistance thermometry, General purpose thermo couples, J/K/R/S & PT-100(RTD) etc, Mineral Insulated Thermo couples, principle of thermocouples. PTC/NTC Thermostats, Construction & Principle working, operation of Liquid-in-glass thermometer and Liquid-in-metal thermometers, Construction & Principle working, operation and testing of Vapour, pressure thermometer. Construction	Identification, construction, principle , safety precautions and method of use of Thermo Meters, & Indicators • Mercury thermometers, • Stick dial mercury thermometer, • Digital Temp indicator, • Single & Multi channel digital tem indicators Identification, use &. Test thermo couples Installation and Testing of thermocouples Construction & Principle working ,operation and testing Thermo-electric pyrometer Moving coil pyrometer construction, repairing and testing Moving coil pyrometer

	& Principle working, operation and testing of Bimetallic thermometer. Construction of Moving coil pyrometer. Construction, repairing and testing. Resistance thermometer. definition, of pyrometer, Optical pyrometers, principle, Construction operation of different types, Radiation pyrometer principle and operation Factors governing the operation of A.T.C. Compensating leads, necessity of compensating leads its material. Cold junction compensation necessity and types.	Construction, repairing and testing of Potentiometer pyrometer
7	**Strain Measurements**: Electrical strain gauges wire & foil type materials, Adhesives configuration, Protective coatings, Bonding, Temp. Compensation, calibration, Applications Renascence gauges. Sensors : Proximity sensors, Photo electric Sensors, plug type sensors, univocal, bipolar, techo, leno, liner, FD, Button, Square, level sensors, float type of sensors, Inductive, Capacitive, optical, & Magnetic Proximity sensors Magnetic Float switches & Read Switches	Identification testing, fitting, Connecting & use of various thermostats, float & reed Switches. Making the bimetallic strip, base & screw assembly for thermostat switch and Assemble the thermostat switch .
8	**Basics of Control systems**, block diagram of Functional elements & their types, Open loop/Closed loop, concept of feed back, Transfer function, PID, gain margin stability,, Single point temperature controller & multi point controller. **Familiarization with Environmental pollution monitoring system:** Air pollution monitoring instrument-carbon monoxide, sulphuric oxide, nitrogen dioxide, hydrocarbon and ozone. Smoke monitor, dust monitor, visible emission monitoring system **Indicator, Recorders and controllers :** Single point indicator, multi point indicator, analog and	Experiment on Open loop control system Familiarization, Identification on Proximity sensor for various Pollution Practical work on analog and digital recorders and indicator Practice on data acquisition with PC based data acquisition system and data logging software. Visit to industry for acquaintance to conventional techniques.

	digital indicators, **Recorders :** Analog recorders, digital recorder, operating mechanism, strip charge recorders, circular recorders, x-y recorders, single point, multipoint recorders, **DATA LOGERS,** data acquisition system, supervisory control system, direct digital control, concept of programmable logic control(PLC) ,	

MODULE : IBT – 06 BASIC COMPUTER SKILL
DURATION : 8 WEEKS

Week No.	PRACTICAL	THEORY
1	Demo of working of Computer, demo of input and out put devices, their features, handling and handling precautions, Identify external ports and connectors; identify types of connectors and interconnections, practice removing and interconnecting. Floppy drive and storage media. CD Rom drive, media and usage, Mouse, Scanners, Printers	Introduction to Computers, What is Computer, History, Classification and various use of computers. Characteristics of Computer, Basic construction and working of Digital computer, Concepts of input and output devices and their ports, types of ports used in PC, identification tips and techniques, Various types of Input, Output, devices & printers: DMP, Inkjet, Color Laser Printer, & plotter. , Concept of memories & Storage Devices, Networking Devices
2	**Features of Windows as an operating system** • Start & Shutdown • Creating and operating on the icons • Opening closing and sizing the windows • Using elementary job commands like-creating, saving, modifying, renaming, finding and deleting a file • Creating and operating on a folder • Changing setting like, date, time color (back ground , Screen saver etc) • Using short cuts • Using on line help	Software, types of software, Concept of Operating System, Single User, Multi user Operating Systems, DOS, Windows, Networking environment, Concept of LAN & VAN, Application Software & package Software, Concept of Driver Software, Installing And Uninstalling Drivers. Starting and shutting down PC. Identify computers on desktop. Identify drives and capacity. Creation folders on Desktop and drive using windows & DOS Basic internal & main external Dos Commands Virus and ant virus programs types and symptoms.
3 - 4	**MS WORD** • **File management:** • Opening, creating and saving a document, locating files, Copying contents in some different file (s), protecting files, Giving password protection for a file • **Page Set up**: • Setting margins, tab setting, ruler, indenting • **Editing a document:** Entering text, Cut, Copy, paste	Various Method of Editing of Documents, Concept of Editing, Formatting, saving, reusing, printing, exporting & Transfer of Documents Concept to text processing, overview of Note Pad, Word Pad, MSWORD, bars and controls, description of options in the file edit and view menu, using short cuts.

	• **Formatting a document:** • Using different fonts, changing font size and colour, changing the appearance through bold/ italic/ underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods, Aligning of text in a document, justification of document, Inserting bullets and numbering • **Formatting paragraph**, inserting page breaks and column breaks • **Use of headers, footers:** Inserting footnote, end note, use of comments • Inserting date, time, special symbols, importing graphic images, drawing tools • **Tables and Borders**: • Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table • **Print preview, zoom**, page set up, printing options • **Using Find, Replace options** • **Using Tools like:** • Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelops and labels • Using shapes and drawing Toolbar, **Working with more than one,** **Inserting of word art & picture**, Word Art or other objects in the document and their formatting as per requirement	Concept of preparation of various Documents. Viz. Correspondence, Operation & Service Manuals, Call Reports, Inventory Vouchers, Merging of Documents for mail/email/Fax

5	**POWER POINT** Starting Ms Power Point And Viewing A Presentation. Creating Presentation Slides With Text And Images. Animating Text And Graphics. Sound Movies. Record Presentation Narration. Packing A Presentation.	Concept and importance of presentation, presentation techniques, Features of Ms Power Point. Planning presentation. Creating Text And Picture Animations. Adding Sound For Slides. Adding Movies To Slide. Rehearsing Timing And Recording Presentation Narration.
	MS-EXCEL **Starting excel, open Worksheet, enter, edit, Data, formulas to Calculate values, format Data, create chart, printing Chart, save worksheet, Switching from another spread sheet** **Menu Commands:** Create, format charts, organize, manage data, solving problem by analyzing data, exchange with other applications Programming with MS-Excel, getting information while working **Work books:** Managing work books (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations, working with arrays **Editing a worksheet**, copying, moving cells, pasting, inserting, delectation cells, rows, columns, find and replace text, numbers of cells, formatting worksheet **Creating a chart**: Working with chart types, changing data in chart, formatting a chart, use chart to analyze data Using a list to organize data, sorting and filtering data in list	Concept of worksheet Features & limitations of Ms Excel and Parts of A Excel Sheet. Entering and editing Data in Cells of a Excel Sheet. Features of file and edit menu. Using short cuts. Description of feature of inserts and format menu and uses with examples. Concept of BAR CHART< PIE CHART Description of features of tools menu and concept of data table and features of data menu. Examples using multiple worksheet and books.

	Retrieve data with MS-query: Create a pivot table, customizing a pivot table, Statistical analysis of data **Customize MS-Excel**: How to change view of worksheet, outlining a worksheet, customize workspace, using templates to create default workbooks, protecting workbook **Exchange data** with other application: linking and embedding, embedding objects, linking to other applications, import, export document. Practice using multiple worksheet and books and printing of worksheets.	
7	**Internet** **Log-in to internet ,** Creating **E-mail** account, E-mail Sending and receiving e-mail , Creating a message , Creating an address book, Attaching a file with e-mail message, Use of voice mail and Chatting Surfing/Reading/ Replying/Deleting/ E-mail to multiple recipients. **Navigation for information** seeking on internet , USE OF various search engine, searching of information, Download, Read, Save net contents, Conversion of format like PDF to Word or other etc. Maintenance of PCs and its Peripherals (Hard Disk, Floppy disk, Anti Virus software, Printer(s)	Concept of Internet, Term used in web Technology, creation of e-mail account, sending and the receiving mails, use of search engine, Net Surfing, on Line Chat and extra use of net like down load, gathering of desired information
8	**Maintenance:** Preventive maintenance of Computer Equipment, Concept of loading of Operating System, Software Drivers for Mother Board, Auxiliary input and output devices and peripherals.	Practice of connecting of input and output devices such as Floppy Drive, Storage Disk, CD Drives, Scanner, Printer, Key Board Mouse, etc. Practice loading of drivers and operating System.

MODULE : IBT – 07 WORKSHOP CALCULATION & SCIENCE

DURATION : 4 WEEKS

OBJECTIVE :

- To understand basic mathematical calculation used in Electrical Engineering
- To understand different types units & their conversion.
- To understand heating & temperature effects on different materials & their basic properties.
- To understand the concept of Work, Power & Energy.
- To understand metallurgy of various material i.e. Iron, Steel, Copper & Zinc etc.
- To draw free hand sketches & projections of Electrical Engineering Ckts
- Concept of calculating the Area, Volume, Perimeter etc of different objects.

COURSE CONTENTS:

THEORY

(A) MATHEMATICS

- Applied workshop problems involving multiplication, division.
- Common fractions, additions, subtractions, multiplications and division of fractions. Application of fractions to shop problems. Reduction of common fractions to decimal fractions.
- Decimals-addition, subtraction, multiplication, conversion from decimal to common fraction shop problems.
- Square roots- the square root of a perfect square of whole number and of decimals.
- Percentage and its application. Shop problems.
- Metric system – Metric weights and measurements. Units and conversion factors. Shop problems on metric system of weights and measurements.
- Algebraic symbols, addition, subtraction, multiplication and divisions of expressions involving algebraic symbols. Simple equations and transposition problems. Standard formulae, simple simultaneous equations with two unknown quantities. Simple algebraic problems.
- Menstruation- area of rectangles, squares, triangles, circles regular polygons etc. Calculation of areas Calculation of volume and weight of simple solid bodies such as cubes squares and hexagonal prisms – shop problems on determination of volume and weight of simple solid bodies.
- Trigonometry – trigonometric functions – Use of trigonometric tables – applied problems. Calculation of area of triangles and polygons with the aid of trigonometry.
- Logarithm-Use of tables for multiplication & division.
- Reading of simple graphs. Exercises in reading monographs. Calculations of volume and weight of simple solid bodies by using logarithm.

(B) SCIENCE

- Mass, units of mass, force, weight of a body, units of weight, shop problems-C.G.S. and SI systems of units of force, weight etc. and their conversion Shop problems.
- Heat and temperature – thermometric scales – Conversion of F to Centigrade and vice versa. Temperature measuring instruments used in workshop.
- Heat treatment, hardening, annealing, tempering and normalizing. Care hardening, their standards and measurements.
- Meaning of tenacity, elasticity, malleability, brittleness hardness compressibility and ductility – examples.
- Different forms of energy, Work, units of work, energy, power/Simple applied problems, Horse power and brake H.P. Mechanical advantage & velocity ratio. Applied problems.
- Meaning of stress, strain modules of elasticity and ultimate strength. Examples. Factor of safety.
- Atomic, Structure, Conductor, insulator, semiconductors, Electricity and its uses, Electric current, positive and negative terminals, Use of switches and fuses. Conductors and insulators, Ohm's Law and Kirchoff's Law.
- Properties and uses of cast iron, wrought iron, plain carbon steel, H.S.S. and alloy steel. Brief description of manufacturing process of pig iron and cast iron. Effect of alloying elements on properties of cast iron and steel.
- Properties and uses of copper, zinc, lead, tin, aluminium, brass, bronze, solder, bearing metals, chromium, Nickle, titanium etc.

MODULE: IBT – 08 ENGINEERING DRAWING

- Free hand sketching of straight lines, rectangles, circles, polygons, simple solids, cube rectangular blocks cylinders etc. their dimensioning.
- Free hand sketching nuts, bolts, rivets, washers, keys, screw threads, keys with dimensions from samples. dimensioning technique.
- Explanation of simple orthographic projection-1st angle and 3rd angle. Sketching of different views of simple solid and hallow bodies with dimensions
- Use of different types of lines and symbols for drawing welding symbols, electrical and electronics symbols, sketching of simple house wiring diagrams.
- Simple isometric drawing Isometric views of square, rectangle, circle, cubes, various types of prism.
- Use of drawing instruments T-square and drawing board their care and maintenance drawing simple figures and solids with dimensions and titles. Use of different types of scales lettering numbers and alphabets-isometric drawing with dimensions of various simple objects.
- Sections and sectioning-orthographic views of various solids and hollow objects with section views.
- Blue print reading-Preparation of simple working drawings from sketches.
- Schematic diagram of star-delta starter, Reversing magnetic starter, panel board wiring, push button control of two=speed motor. Single line diagram of substation feeder. Schematic diagram of power generation station.
- Block & Schematic diagram of CRO, Function generator, Regulated power supply, Digital multimeters, Digital thermometer etc.

Terminal Objective:

After completion of participants will be able to:

- do all the calculation used in electrical engineering ckts.
- know about all the basic properties of material used in electrical engineering circuits mark according to given sketch, file the given job with accuracy of .25mm, drill & tap by hand.

LIST OF TOOLS AND EQUIPMENT FOR BASIC ENGINEERING SKILL – I

S.No.	Tool Kit	Quantity
1.	Rule steel 15 cms	16 Nos.
2.	Square try 10 cm blade	
3.	Caliper outside 15 cms spring	
4.	Caliper inside 15 cms spring	
5.	Divider 15 cms spring	
6.	Scriber 15 cms	
7.	Punch center 10 cms	
8.	Chisel cold 19 mm	
9.	Hammer Ball pein 0.22 kg with handle	
10	File flat 25 cm second cut	
11.	File flat 25 cm smooth	
12.	Hacksaw frame adjustable 20-30 cm	
13.	Pad saw with 3 blades	
	TOOLS INSTRUMENTS AND GENERAL SHOP OUTFIT	
1.	Rule steel 30 cms	8 Nos.
2.	Mallet wooden 0.66 Kg.	
3.	Soldering copper 0.27 Kg	
4.	Crosspein hammer 0.22 kg.	
5.	Steel tape 2 mts	
6.	Rule, four fold wooden 600 mm	
7.	Marking knife	
8.	Screw driver 300 mm	
9.	Square try 200 mm	
10.	Saw, hand 450 mm	
11.	Saw tenon 300 mm	
12	Chisel firmer 12 mm to 22 mm by 2mm - 5 each	
13.	Hammer, cross pein carpenter 600 gms with handle	
14.	Plane jack 450 mm wooden stock 50 mm cutter	
15.	Chisel mortise 3 mm to 20 mm by 2mm - 5 each	
16.	Gauge mortise and marking	
17.	Stonc oil 150 mm x 20 mm x 25mm	
18.	Centre punch	
19.	Straight edge 46 cm steel	4 Nos.
20.	Plate surface 45 x 45 cms	4 Nos.
21.	Key Hole saw	4 Nos.
22.	Carpenter vices	4 Nos.
23.	Firmer chisel (different sizes)	8 Nos.
24.	Universal scrumbling block	4 Nos.
25.	Drill brace hand 0 to 12mm	8 Nos.
26.	Drill twist s/s 1.5 mm to 12mm by 0.4(1 each)	4 Nos.
27.	Taps and dies complete set in BA	2 Nos.
28.	Taps and dies complete set up to 15 mm by .5 mm in Metric	1 each
29.	Taps and dies complete set in with worth	2 Nos.
30.	File round 30 cm bastard	4 Nos.

31.	Stone, Carborandum 15 cm x 5 cm x 4 cm	08 Nos.
32.	File flat 30 cm 2nd cut	4 Nos.
33.	Can oil 0.25litre	4 Nos.
34.	Clamp “c” 5 mc	4 Nos.
35.	Chisel cold 19 mm flat	4 Nos.
36.	Drill chuck 12 mm	4 Nos.
37.	Pipe vice no.4	4 Nos.
38.	Vice bench 12 mm jaw	4 Nos.
39.	Bench working 240 x 120 x 60cm	4 Nos.
40.	Almirah 180 x 40 x 30 cm	4 Nos.
41.	Lockers with standard 10 drawers	2 Nos.
42.	Metal rack 182 cm x 182cm x 45 cm	2 Nos.
43.	Desk	As required
44.	Table and Chair for Instructor	2 Nos.
45.	Fire brackets	2 Nos.
46.	Trammel	1 No.
47.	Clamp 150 mm set	08 Nos.
48.	Plane, trying 75 mm	08 Nos.
49.	Plane, rebate adjustable	8 Nos.
50.	File rasp bastard 250 mm	08 Nos.
51.	Ratchet brace 250 mm	8 Nos.
52.	Bit center 6,8,10& 12 mm	4 Nos.
53.	Auger 12,16,20,22 & 25 mm	4 Nos.
54.	Gouge, firmer 6,10,12 & 15 mm	4 Nos.
55.	Timmons square 45 cm x 60 cm	4 Nos.
56.	Standard sheet metal gauge	08 Nos.
57.	Stake hatchet	08 Nos.
58.	Stake round and bottom	8 Nos.
59.	Stake funnel	4 Nos.
60.	Anvil face 12 cm x 7 cm	4 Nos.
61.	Bick iron	4 Nos.
62.	Horse stake	2 Nos.
63.	Hammer creasing	8 Nos.
64.	Hammer Planishing	8 Nos.
65.	Sheer tin-man’s 25 cm	08 Nos.
66.	Snip straight 20 cm	08 Nos.
67.	Snip bent 20 cm	8 Nos.
68.	Rivet set and snap combined 4 mm	8 Nos.
69.	Chisel cold, flat 25 mm	8 Nos.
70.	Combination plier insulated	4 Nos.
71.	Nose plier	4 Nos.
72.	Clamping &crimpling plier	4 Nos.
73.	Cock plier adjustable	4 Nos.
74.	Grover 4 mm	2 Nos.
75.	Soldering iron 425 gm	2 Nos.
76.	Hammer raising 0.45 Kg	2 Nos.
77.	Filler gauge	2 Nos.
78.	Vernier Callipers	08 Nos.

79.	Screw gauge	08 Nos.
80.	Depth gauge	08 Nos.
81.	Plumber's Vice	8 Nos.
82.	Die set(plumber)	8 Nos.

	GENERAL INSTALLATION	
1.	Drilling machine bench sensitive 0-12 mm Cap Motorised with chuck and key complete	2 Nos.
2.	Grinding machine (General purpose) D.E. pedestal with 17 mm dia Wheels rough and smooth with twist drill Grinding attachment	2 Nos.
3	Light general purpose portable forge	1 No.
4.	Guilletine squaring smears foot-operated	1 No.
5	Welding set (ac)	2 Nos.
6.	Oxy-acetylene welding set	2 Nos.
7.	Portable Drilling M/c 0-12 mm capacity with chuck, keys and all other accessories	2 Nos.
8	Bend saw m/c with detachable and adjustable circular blades, with all attachment and accessories	2 Nos.
9.	Motorised planner and grooving m/c with 4' steel bed adjustable with all attachments abd accessories	2 Nos.
10	Spot welding m/c with controller all attachments and accessories	1 No.
11	Seem welding M/c with controller all attachments and accessories	1 No.
12	Conduit pipe bending M/s (manual)with bending attachments	1 No.
13	Buffing machine (double ended)with attachments	1 No.

LIST OF TOOLS AND EQUIPMENT FOR BASIC ENGINEERING SKILL –2

S.No.	Tool Kit	Quantity
1.	Rule Steel 15 cms	16 Each.
2.	Square Try 10 cms	
3.	Caliper Outside 16 cms spring	
4.	Caliper Inside 15 cms spring	
5.	Divider 15 cm spring	
6.	Scriber 15 cms	
7.	Punch Centre 10 cms	
8.	Hacksaw frame adjustable	
9.	File Flat 25 cms smooth	
10.	Ball Pein Hammer 0.22Kg	

S.No.	TOOLS/INSTRUMENTS AND GENERAL SHOP OUTFIT	Quantity
1.	Steel Rule 60 cms	8 Each
2.	Screw Driver 300 mm	
3.	Square Try 200 mm	
4.	Taps & Dies Complete set in b A	4 Each
5.	Taps & Dies in Metric 3mm /15mm (steps in 1mm)	
6.	Drill Twist SS 3mm to 25 mm by 1mm	
7.	Taps & Dies complete set in whit worth	
8.	File round 30 cm bastard	4 Each .
9.	File flat 30 cm 2nd cut	
10.	Drill chuck 12mm	2 Nos.
11.	Vice Bench 12mm jaw	4 Nos.
12.	Working Bench 240 x 120 x 60 cm	2 Nos.
13.	Lockers with standard 10 drawers	
14.	Almirah 180 x 40 x 30 cm	2 Nos.
15.	Desk & Bench	As required
16.	Table with chair for Instructor	2 Each
17.	Hammer raising 0.45 Kg	4 Nos.
18.	Filler Gauge	8 Nos.
19.	Vernier Callipers	4 Nos.
20.	Screw Gauge	
21.	Depth gauge	
22.	Chizzel cold	8 Nos.
23.	Ball Pein Hammer 500gms	4 Nos.
24.	Combination Plier	4 Nos.
25.	Clock Plier	4 Nos.
26.	Nose Plier	4 Nos.
27.	Bevel Protector	4 Nos.
28.	Double Ended Spanner Set	4 Nos.
29.	Box Spanner Set	4 Nos.
30.	Allen Key set	4 Nos.
31.	Allen Key Set (Miniature)	4 Nos.

32.	Oil can 500ml	4 Nos.
	GENERAL INSTALLATION	
1.	Drilling Machine Bench 0-12mm motorized with chuck complete	2 Nos.
2.	DE Pedestal Grinding Machine 17mm dia wheels rough and smooth with twist drill grinding attachment	2 Nos.
3.	Plastic Pipe extruder sizes ½" to 2" (1/2" step)	1 No.
4.	Plastic Injection Molding Machine	1 No.
5.	Instrument Lathe 2' size with Magnetic chuck & ¾ jaw chuck	2 Nos.
6.	*CNC Trainer with all necessary Holding, cutting, etc. attachment and accessories and software	2 Nos.
7.	Shaper 2" movement	2 Nos.
8.	Universal Milling Machine with all accessories	2 Nos.
9.	Portable Drilling Machine 0 – 12mm heavy duty & precision	2 Nos.
10.	Lathe machine 4" size with all accessories 4 jawed 33 aw chuck	2 Nos.
11.	Horizontal Milling Machine with all accessories	1 No.
12.	Vertical Milling Machine with all accessories	1 No.
13.	Surface Grinding Machine with attachment	1 No.
14.	Power Hacksaw Machine	2 Nos.

LIST OF TOOLS & EQUIPMENT FOR BASIC ELECTRICITY AND ELECTRICAL INSTRUMENTATION

S No	Name of Tool & equipment	Qty
1.	Screw Drivers 100mm	16 Nos.
2.	Screw Drivers 150 mm	16 Nos.
3.	Screw Drivers 300mm	16 Nos.
4.	Screw Drivers Heavy Duty	16 Nos.
5.	Screw Drivers Star Type	16 Nos.
6.	Screw Drivers Set	16 Nos.
7.	Screw Driver Set Philips Type	16 Nos.
8.	Neon Tester	16 Nos.
9.	Combination Pliers	16 Nos.
10.	Long Nose Pliers,	16 Nos.
11.	Side Cutting Pliers	16 Nos.
12.	Wire Stripers	16 Nos.
13.	Crimping and Clamping Pliers	8 Nos.
14.	Hand Drill machine	8 Nos.
15.	Motorized portable drill machine	4 Nos.
16.	Drill bit set	4 Nos.
17.	Hammer ball pein 0.250 Kg	4 Nos.
18.	Hammer ball pein 0.500 Kg	4 Nos.
19.	Hammer cross pein 0.250 kg	4 Nos.
20.	Hack Saw frame 200mm	8 Nos.
21.	Soldering Iron 15W	08 Nos.
22.	Soldering Iron 30W	08 Nos.
23.	Soldering Iron 65W	4 Nos.
24.	Soldering Gun 250 W	4 Nos.
25.	Temperature Control Soldering & Desoldering Station 15W	4 Nos.
26.	Files Flat 2nd Cut 150mm & 300mm	4 Nos.
27.	File Flat Smooth 150 mm & 300 mm	4 Nos.
28.	Snip Straight	4 Nos.
29.	Snip Curved	4 Nos.
30.	Steel Rule & Steel tape	4 Nos.
31.	Micro meter	2 Nos.
32.	Double ended and Box spanners set	8 Each
33.	Moving Iron Volt meters diff ranges 0-10, 50, 100, 300,	8 Each
34.	Moving Coil Volt meters 0-1, 5, 10, 30, 100, 300v (Ac)	8 Each
35.	Moving Coil Volt meters 0-1, 5, 10, 30, 100, 300v (Ac)	8 Each
36.	Moving Iron Ampere meters 0-1,2,5,10,20 Amp	8 Each
37.	Moving Coil Volt meters 0-1, 5, 10, 30, 100, 300v (Ac)	8 Each
38.	Moving Coil Amp meters 0-100ma, 500ma,1, 5, 10, Amp(Ac)	8 Each
39.	Moving Coil Amp meters 0-100ma, 500ma, 1, 5, 10, Amp DC)	8 Each
40.	Tong tester with all Voltage current and continuity testing	8 Nos.
42.	Singe phase Wattmeter 230V 5kVA	4 Nos.

43.	Megger	4 Nos.
44.	Earth tester	4 Nos.
45.	Analog Multimeter	08 Nos.
46.	Digital Multimeter 3 -1/2 Digit	04 Nos.
47.	Digital Multimeter 4 -1/2 Digit with capacitance, inductance, frequency and db, temperature Measurement facility	04 Nos.
48.	LCR Bridge	2 Nos.
49.	Digital LCR meter	2 Nos.
50.	Function Generator	2 Nos.
51.	CRO 10 MHz	2 Nos.
52.	CRO 20 MHz Dual Trace	2 Nos.
53.	Storage Oscilloscope 100 MHz	1.Nos.
54.	AF & RF Signal Generatorator	4 Nos.
55.	AF Power Out put meter	2 Nos.
56.	Dc Regulate Power Supply 0-30 V 1A	8 Nos.
57.	Dc Regulate Power Supply 0-30 V 2A	8 Nos.
58.	SMPS Based Regulated Power Supply	8 Nos.
59.	Inverter 1 KVA	2 Nos.
60.	Voltage Stabilizers 2 KVA	4 Nos.
61.	LEAD ACID Batteries 120 AH	4 Nos.
62.	Battery Charger SCR/ MOSFET based 6A with protections	6 Nos.
63.	Energy Meter	6 Nos.
64.	Moving Coil Galvanometers (Differ rent types)	04 Nos.
65.	Decade Resistance Box	4 Nos.
66.	Decade Inductance Box	4 Nos.
67.	Wheat stone Bridge Experiment Kit	4 Nos.
68.	L C R Bridge Trainer Kit	4 Nos.
69.	Single phase Induction motor	2 Nos.
70.	Capacitor start Single phase motor	2 Nos.
71.	Three phase Induction motor	2 Nos.
72.	Hot wire type Instrument Training Kit	4 Nos.
73.	Thermo couple type Instrument Training Kit	4 Nos.
74.	Rectifier type Instrument Training Kit	4 Nos.
75.	Latest pilferage free KWH meter	6 Nos.
76.	Bar & Horse shoe magnets	8 Nos.
77.	Horse shoe magnets	8 Nos.
78.	Magnetic needle compass	16 Nos.
79.	Transformer training Kit	4 Nos.
80.	Standard Wire Gauge	4 Nos.

LIST OF TOOLS & EQUIPMENTS FOR BASIC ELECTRONICS AND ELECTRONICS INSTRUMENTATION

S No	Name of Tool & equipment	Qty
1.	Screw Drivers 100mm	16 Nos.
2.	Screw Drivers 150 mm	16 Nos.
3.	Screw Drivers 300mm	16 Nos.
4.	Screw Drivers Heavy Duty	16 Nos.
5.	Screw Drivers Star Type	16 Nos.
6.	Screw Drivers Set	16 Nos.
7.	Screw Driver Set Philips Type	16 Nos.
8.	Neon Tester	16 Nos.
9.	Combination Pliers	16 Nos.
10.	Long Nose Pliers,	16 Nos.
11.	Side Cutting Pliers	16 Nos.
12.	Wire Stripers	16 Nos.
13.	Crimping and Clamping Pliers	8 Nos.
14.	Hand Drill machine	8 Nos.
15.	Motorized portable drill machine	4 Nos.
16.	Drill bit set	4 Nos.
17.	Hammer ball pein 0.250 Kg	4 Nos.
18.	Hammer ball pein 0.500 Kg	4 Nos.
19.	Hammer cross pein 0.250 kg	4 Nos.
20.	Hack Saw frame 200mm	8 Nos.
21.	Soldering Iron 15W	08 Nos.
22.	Soldering Iron 30W	08 Nos.
23.	Soldering Iron 65W	4 Nos.
24.	Soldering Gun 250 W	4 Nos.
25.	Temperature Control Soldering & Desoldering Station 15W	4 Nos.
26.	SMD Soldering Desoldering Stations with accessories	4 Nos.
27.	Files Flat 2nd Cut 150mm & 300mm	4 Nos.
28.	File Flat Smooth 150 mm & 300 mm	4 Nos.
29.	Snip Straight	4 Nos.
30.	Snip Curved	4 Nos.
31.	Steel Rule & Steel tape	4 Nos.
34.	Double ended and Box spanners set	2 Each
35.	Moving Iron Volt meters diff ranges 0-10, 50, 100, 300,	2 Each
36.	Moving Coil Volt meters 0-1, 5, 10, 30, 100, 300v (Ac)	2 Each
37.	Moving Coil Volt meters 0-1, 5, 10, 30, 100, 300v (Ac)	2 Each
38.	Moving Iron Ampere meters 0-1,2,5,10,20 Amp	2 Each
39.	Moving Coil Volt meters 0-1, 5, 10, 30, 100, 300v (Ac)	2 Each
40.	Moving Coil Amp meters 0-100ma, 500ma, 1, 5, 10, Amp (Ac)	2 Each
41.	Moving Coil Amp meters 0-100ma, 500ma, 1, 5, 10, Amp DC)	2 Nos.
42.	Tong tester with all Voltage current and continuity	4 Nos.

	testing	
43.	Brad Board with + 5v, +12 V Power supply, & pulse generator	8 Nos.
44.	Singe phase Wattmeter 230v 5kVA	4 Nos.
45.	Megger	2 Nos.
46.	Earth tester	2 Nos.
47.	Analog Multimeter	4 Nos.
48.	Digital Multimeter 3 -1/2 Digit	8 Nos.
49.	Digital Multimeter 4 -1/2 Digit with capacitance, inductance, frequency and db, temperature Measurement facility	4 Nos.
50.	LCR Bridge	4 Nos.
51.	Digital LCR meter	4 Nos.
52.	Function Generator	6 Nos.
53.	CRO 10 MHz	4 Nos.
54.	CRO 20 MHz Dual Trace	2 Nos.
55.	Storage Oscilloscope 100 MHz	2 Nos.
56.	AF & RF Signal Generator	4 Nos.
57.	AF Power Out put meter	2 Nos.
58.	Dc Regulate Power Supply 0-30 V 1A	8 Nos.
59.	Dc Regulate Power Supply 0-30 V 2A	8 Nos.
60.	SMPS Based Regulated Power Supply	8 Nos.
61.	Inverter 1 KVA	4 Nos.
62.	UPS off line 750 VA	6 Nos.
63.	Voltage Stabilizers 2 KVA	4 Nos.
64.	LEAD ACID Batteries 120 AH	As Reqd
65.	Battery Charger SCR/ MOSFET based 6A with protections	6 Nos.
66.	Transistor Tester	4 Nos.
67.	Distortion Factor meter	4 Nos.
68.	Digital Experiment Trainer Kit (combined)	8 Nos.
69.	Digital Logic gate Trainer Kit	8 Nos.
70.	Digital IC Tester	4 Nos.
71.	In Circuit Digital IC Tester	2 Nos.
72.	Analog IC Trainer Kit	6 Nos.
73.	8085 /8086 Micro processor trainer Kit with Application interface facility	4 Nos.
74.	EPROM Program Programmer Kit & EPROM eraser	4 Nos.
75.	LVDT Trainer Kit with accessories	4 Nos.
76.	Pressure Transducer Trainer Kit and measurement system using strain gauge and piezo electric sensor	2 Nos.
77.	Load Cell Kit	2 Nos.
78.	Characteristics cum trainer Kit for Diodes , BJT, UJT, JFET, MOSFEEET, SCR, DIAC, TRIAC	As Reqd.
79.	Characteristics cum trainer Kit for Amplifiers	As Reqd.
80.	Characteristics cum trainer Kit for Oscillators	As Reqd.
81.	Decade resistance box	4 Nos.

82.	Decade Capacitance Box	4 Nos.
83.	Decade Inductance Box	4 Nos.
84.	DC Micro motors	6 Nos.
85.	AC micro motors	2 Nos.
86.	Stepper Motors Trainer with Driver Circuit and attachment	4 Nos.
87.	Trainer Kit SCR/ TRIAC for motor control with all attachments	2 Nos.
88.	WHEAT Stone Bridge Trainer Kit	2 Nos.
89.	LCR Bridge Trainer Kit	2 Nos.
90.	Digital LC R meter	2 Nos.
91.	S M P S Trainer Kit	2 Nos.

LIST OF TOOLS & EQUIPMENTS FOR MEASUREMENT & MEASURING INSTRUMENTS

S No	Name of Tool & equipment	Qty
1.	Screw Drivers 100mm	16 Nos.
2.	Screw Drivers 150 mm	16 Nos.
3.	Screw Drivers 300mm	16 Nos.
4.	Screw Drivers Heavy Duty	16 Nos.
5.	Screw Drivers Star Type	16 Nos.
6.	Screw Drivers Set	16 Nos.
7.	Screw Driver Set Philips Type	16 Nos.
8.	Neon Tester	16 Nos.
9.	Caliper out side 15 Cm	2 Nos.
10.	Caliper Inside	2 Nos.
11.	Divider Inside	2 Nos.
12.	Scriber 15 Cm	2 Nos.
13.	Vernier Caliper	16 Nos.
14.	Micro meter	16 Nos.
15.	Spherometer	16 Nos.
16.	Vernier Height Gauge	2 Nos.
17.	Bevel protractor	2 Nos.
18.	Combination Pliers	16 Nos.
19.	Long Nose Pliers,	16 Nos.
20.	Side Cutting Pliers	16 Nos.
21.	Wire Stripers	16 Nos.
22.	Crimping and Clamping Pliers	8 Nos.
23.	Hand Drill machine	8 Nos.
24.	Motorized portable drill machine	4 Nos.
25.	Drill bit set (sizes as required)	4 Nos.
26.	Hammer ball pein 0.250 Kg	4 Nos.
27.	Hammer ball pein 0.500 Kg	4 Nos.
28.	Hammer cross pein 0.250 kg	4 Nos.
29.	Hack Saw frame 200mm	8 Nos.
30.	Steel Rule 30 Cm	4 Nos.
31.	Files Flat 2nd Cut 150mm & 300mm	08 Nos.
32.	File Flat Smooth 150 mm & 300 mm	08 Nos.
33.	File Round smooth	2 Nos.
34.	File Half Round Smooth	2 Nos.
35.	File Half Round 2nd Cut	2 Nos.
36.	File Half Round 2nd cut	2 Nos.
37.	Steel Rule & Steel tape	15 Nos.
38.	Can oil 0.25 Lts	2 Nos.
39.	Can oil 0.5 Lts	2 Nos.
40.	Chisel Cold 19mm flat	2 Nos.

41.	Chisel Cold 25 mm	2 Nos.
42.	"C" Clamp 5 cm	2 Nos.
43.	Bench Vice 12 Cm jaw	4 Nos.
44.	Anvil Face 12 cm X 7 Cm	2 Nos.
45.	Hammer Creasing,	2 Nos.
46.	Hammer Planishing	2 Nos.
47.	Box spanners set	2 Nos.
48.	Snip Straight 20 Cm	4 Nos.
49.	Snip Curved 20 Cm	4 Nos.
50.	Rivet Set and snap combined 4mm	2 Nos.
51.	Double ended and Box spanners set	2 Nos.
52.	Soldering Iron 15W	08 Nos.
53.	Soldering Gun 250 W	4 Nos.
54.	Tong tester with all Voltage current and continuity testing	4 Nos.
55.	Singe phase Wattmeter 230v 5kVA	1 No.
56.	Earth tester	1 No.
57.	Analog Multimeter	04 Nos.
58.	Digital Multimeter 4 -1/2 Digit with capacitance, inductance, frequency and db, temperature Measurement facility	8 Nos.
59.	Digital LCR meter	4 Nos.
60.	Function Generator	6 Nos.
61.	CRO 20 MHz Dual Trace	4 Nos.
62.	Drilling Machine 0-12mm motorised with Chucks, Keys All Accessories	2 Nos.
63.	Tele Scope	2 Nos.
64.	Astronomy Telescope	2 Nos.
65.	Binocular	2 Nos.
66.	Student Microscope with all attachments	2 Nos.
67.	Medical Microscope with all attachments	2 Nos.
68.	Industrial microscope with all attachments	2 Nos.
69.	Tool maker Microscope with all attachments	2 Nos.
70.	Optical Tachometer	2 Nos.
71.	Dc Regulate Power Supply 0-30 V 2A	2 Nos.
72.	SMPS Based Regulated Power Supply	8 Nos.
73.	Inverter 1 KVA	2 Nos.
74.	UPS off line 750 VA	2 Nos.
75.	Voltage Stabilizers 2 KVA	2 Nos.
76.	LEAD ACID Batteries 120 AH	4 Nos.
77.	LVDT Trainer Kit with accessories	4 Nos.
78.	Pressure Transducer Trainer Kit and measurement system using strain gauge and piezo electric sensor	4 Nos.
79.	Load Cell Kit	4 Nos.
80.	Pressure regulator	4 Nos.
81.	Barometer & Recorder	4 Nos.

82.	Borden tube pressure gauge	4 Nos.
83.	Diaphragm and capsule type pressure measurement system	4 Nos.
84.	Hydrometers	4 Nos.
85.	Liquid seal Type Flow meter	4 Nos.
86.	Reciprocating type Piston Type flow meter	4 Nos.
87.	Pivot Type Flow meter	4 Nos.
88.	Orifice Plate Kit	4 Nos.
89.	Ph Meter	4 Nos.
90.	Pin type Bell type and ring type pressure gauge	4 Nos.
91.	Speed measurement Trainer Kit using Techo generator and optical Pulse feed back	4 Nos.
92.	Temperature sensors & measurement System using Thermo couple RDT Thermisters	4 Nos.
93.	Distributed digital Control system	4 Nos.
94.	Thermal Relays	8 Nos.
95.	Thermo couple with potentiometer	4 Nos.
96.	Thermo electric Pyrometer	4 Nos.
97.	Water manometer	8 Nos.
98.	U type manometer	2 Nos.
99.	PC based Data acquisition System	1 No.
100.	Strain gauge	2 Nos.
101.	Humidity sensor	2 Nos.
102.	Liquid filled steel thermometer	2 Nos.
103.	Radiation pyrometer	2 Nos.
104.	Well type manometer	2 Nos.
105.	digital pressure gauge and calibrator	2 Nos.
106.	quantity flow meter	2 Nos.
107.	Rotameter	2 Nos.
108.	Electromagnetic flow meter	2 Nos.
109.	Ultra sonic flow meter	2 Nos.
110.	Capillary Rise Meter apparatuses	2 Nos.
111.	Lab apparatus set to find density & specific gravity	4 Nos.
112.	level Indicator	2 Nos.
113.	Proximity sensors for level, flow, pressure measurement	As Reqd.
114.	Level controller	2 Nos.
115.	Vertex flow meter	2 Nos.
116.	Centrifugal & drag type techo meter	2 Nos.
117.	Stroboscope	2 Nos.
118.	Digital tachometer	2 Nos.
119.	Piston type reciprocating type flow meter	2 Nos.
120.	Multi channel Digital Temperature Indicator with controller	2 Nos.
121.	Moving Coil pyrometer	2 Nos.
122.	Physical balance	2 Nos.

123.	Chemical balance	2 Nos.
124.	Digital weighing machine	2 Nos.
125.	Different type level switches	As Reqd.

LIST OF TOOLS AND EQUIPMENT FOR BASIC COMPUTER

OPERATIONAL SKILL

COMPUTER TO STUDENT RATIO 1 : 2

S.No.	Name of Item	Quantity
1.	Computer Tables (With atleast one draw with lock)	As required.
2.	Computer Operator Chairs	10 Nos.
3.	Printer table	As required
4.	Book Case and Almirah	As required
5.	Instructor table & chair	1 No.
6.	Multimedia Projector	1 No.
7.	PC of configuration P-IV or equivalent with multimedia kit internet cards and preloaded Win 2000/Win XP operating system (with MB manual and CD) with UPS	10 Nos.
8.	Microsoft Office package (Office 2000 or Office XP)	As required
9.	Antivirus software	As required.
10.	Table top Scanner	1 No.
11.	Laser Jet Printer (Mono)	2 Nos.
12.	Inkjet/Deskjet column printer	1 No.
13.	Web Camera	1 Nos.
14.	16 Port Switch	1 No.
15.	Crimping tool for RJ 45/RJ11	1 No.
16.	Modern external and internal	1 External and 1 Internal

CONSUMABLES FOR LAN WIRING

S.No.	Name of Item	Quantity
1.	Utp Se/6 Cable	500 Mtrs.
2.	Information/Data outlets for LAN	15 Nos.
3.	RJ 45 connectors	100 Nos.

TELEPHONE LINE FOR INTERNET SPARES FOR PC MAINTENANCE

.No.	Name of Item	Quantity
1.	Mother Board with integrated sound and display P IV or equivalent) with processor and RAM	2 Nos.
2.	Display card	2 Nos.
3.	Ethernet land	2 Nos.
4.	FDD (1 X 1.2 MB)	4 Nos.
5.	HDD (40 GB or higher) IDE	2 Nos.
6.	CD ROM drive	2 Nos.
7.	Combo drives	2 Nos.
8.	Cabinet with suitable SMPS (ATX)	2 Nos.
9.	Power cards	4 Nos.
10.	HDD/FDD cable set	2 Nos.
11.	Keyboard (Multimedia) & Mouse	2 Nos.
12.	Screw Driver set	2 Nos.
13.	Cleaning Brushes	2 Nos.
14.	Portable Vacuum cleaner	1 No.
15.	PC Maintenance table (4’ x 4’)	2 Nos.
16.	DMP Printer	1 No.