

**Syllabus for the trade  
of**

# **Mechanic Computer Hardware (SEMESTER PATTERN)**

**UNDER  
CRAFTSMAN TRAINING SCHEME**

**Designed in: 2013**

**By**

**Government of India  
Ministry of Labour & Employment (DGE&T)  
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE  
EN – BLOCK, SECTOR – V, SALT LAKE CITY,  
Kolkata – 700 091.**

**List of the Members of Trade Committee Meeting for the trade of Mechanic  
Computer Hardware held at ATI – EPI, Ramanthapur, Hyderabad-500 013.**

**Shri S.J. Amalan, Director, CSTARI, Kolkata**

Sl. No.	Name & Designation Shri/Smt.	Representing Organisation	Remarks
	A.K. Mishra, Director	ATI-EPI, Ramanthapur, Hyderabad	Chairman
	J. Sudharani, Asst. Professor- Medical Bio-Chemestry	G.V.P. College of Engineering for Women, Madhuravada, Visakhapatnam, Andhra Pradesh.	Member
	S. Sambaiah, Director	M/s Medisonics, Flat No. 102, Aries Plaza, Chandana Brother's Building, Mehedipatnam, Hyderabad-28.	Member
	Sandhya Salwan, Director	ATI-EPI, Dehradun.	Member
	D.K. Ojha, Dy. Director	ATI-EPI, Dehradun.	Member
	C. Chandrasekhar, Jt. Director	ATI-EPI, Ramanthapur, Hyderabad	Member
	M.S. Ekambaram, Dy. Director	ATI-EPI, Ramanthapur, Hyderabad	Member
	C.S. Murthy, Dy. Director	ATI-EPI, Ramanthapur, Hyderabad	Member
	T. Ragulan, Dy. Director	ATI-EPI, Ramanthapur, Hyderabad	Member
	V. Subrahmanyam Asst. Director	ATI-EPI, Ramanthapur, Hyderabad	Member

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

<b>Sl. No.</b>	<b>Name &amp; Designation</b>	<b>Organisation</b>	<b>Remarks</b>
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Mukherjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Islan	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

## **GENERAL INFORMATION**

1. Name of the Trade: – **MECHANIC COMPUTER HARDWARE**
2. NCO Code No.
3. Duration :- 02 years (FOUR SEMESTERS)
4. Entry Qualification : Passed 10th class examination under 10+2 system of education with Science and Mathematics or its equivalent.
5. Unit Strength :- 20 (No. of Trainees)
6. Space Norm : 60 Sq. Mtr.
7. Power Norms : 4 kw

**8a.Trainer's Qualification :**

- a) B.E./B.Tech in Electronics/Electronics & Telecommunication/Computer Science/Computer Engineering/Instrumentation.- ( 1 year experience in relevant field)  
OR
- b) Science Graduate with Physics, Mathematics Or Graduate in Electronics.- ( 3 yrs. experience in relevant field)  
OR
- c) Diploma in Computer Science/Technology from recognized board of technical education with two years experience in the relevant field.  
OR
- d) NTC/NAC in the trade with three years experience in the relevant field

**8b.Desirable qualification :** Preference will be given to a candidate with Craft Instructor Certificate (CIC).

**Note:** At least one Instructor must have Degree/Diploma in Relevant trade.

## TRADE : “ Mechanic Computer Hardware”

(Duration : 6 Months)

First Semester.

(Semester Code No. MCH-01)

Week no.	Trade Practical	Trade Theory	Engg. Drg.	Workshop Cal. & Science
1	Practice fixing of screws of different sizes on wooden board. Practice of Cutting on wooden blocks using Tenon saw/6 inch hand saw Drill holes on wooden boards using Electric/Hand Drill Machine. Smoothen the blunt surfaces using suitable files Repeat the above tasks on Metal and Plastic sheets. Practice the electrical safety norms Practice the Mock treatment of electrical shock.	Introduction to NCVT and its certification mechanism Semester system and its flexibility for the Trainee and to the Institute. EM Trade and its applicability in industries. Expectations of the Industry from trainees after the completion of the Trade. The skills to be acquired to become part of industry. Intro to Safety and measures to be taken to maintain the standards of safety of personnel working and the equipment. Different First aid mechanisms to rescue the effected by electric shocks or any physical injuries.	What is Engineering drawing, Importance.	Quadratic equation, Simultaneous linear equation in two variables.
2	Identify the Live, Neutral and Earth on power socket. Construct a test lamp and light a lamp Use a Tester to monitor AC power. Measure the unwanted voltage between the neutral and Ground and take measures to reduce it. Connect two lamps in parallel to the AC Source and observe illumination. Connect two lamps in series to the AC Source and observe illumination Identify different wires and cables. Practice removal of insulation without destroying the strands on wires and cables of different ratings Measure the gauge using SWG Make cable joints using soldering gun Desolder to separate the soldered joints Read and interpret the settings, sockets on an Analog and Digital Multimeters.	<b>Basic terms</b> such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC. Terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, P-P, instantaneous value. Single phase and Three phase power, terms like Line and Phase voltage/ currents. Insulators, conductors and semiconductor properties Different type of electrical cables and their specifications. Different types of Cables used in the electronic industries. Ohm's law and its variables.	Free hand sketching of straight lines, rectangles, square, circles, polygons, etc.	Electricity: Negative & positive polarities, structure of Atoms, Electrons & protons, coulomb, unit of charge, volt, unit of potential difference, and charge in motion is current.
3	Measure and Test the voltage of the given primary/ secondary cell(s). Charge and discharge	<b>Battery /Cells:</b> construction, types of primary and secondary cells, materials	Free hand sketching of tools, reading	Fundamentals and derived

	<p>the cell while measuring the respective Voltage and currents.</p> <p>Measure the voltage and current at different terminals of a resistive circuit Identify an electromagnet and a permanent magnet. Prepare a solenoid valve Prepare an electromagnet for a bell</p> <p>Dismantle and identify different parts of a relay identify coil voltage and contact current capacity.</p> <p>Assemble and test the relay (any four different relays).</p> <p>Repeat the above three tasks for an electrical contractor.</p> <p>Operate a Three phase Induction Motor with three pole EM Contactor having 1 NO + 1 NC auxiliary contacts.</p>	<p>used, specification of cells and batteries. Charging process, efficiency, shelf life, Selection of cells / Batteries etc. Use of Hydrometer. Types of electrolytes used in cells and batteries. Types and Properties of magnets and their materials, preparation of artificial magnets, significance of Electromagnetism, types of cores. Electromagnetic Relays, types, construction, specifications.</p>	<p>of simple drawings and concepts of dimensions.</p>	<p>units, Supplement ary units, of electrical parameters.</p>
4	<p>Identify different transformers Measure the primary and secondary winding resistances for transformers of different capacities (upto 500 VA) Identify different sizes, shapes of cores used in low capacity transformers.</p> <p>Measure the primary and secondary voltage of different transformers. Identify primary and secondary terminals of the centre tapped transformer and test it. Measure input and output voltages of a given isolation transformer Identify different terminals on the given single phase and three phase fractional HP AC Induction Motor. Connect the power and test run Identify unmarked terminals of a three phase induction motor, connect to the DOL starter and run. Connect a DOL starter to the given single phase motor and control it Connect a DOL starter to the given three phase motor and operate it.</p>	<p>Working principle of a Transformer, Transformer construction, Types of cores used Specifications of a transformer. Step-up , Step down and isolation transformers with applications. Different type of losses in Transformers. Phase angle, phase relations, active and reactive power, power factor and its importance in the industry. Three phase Transformers and their applications.</p> <p><b>Electrical motors:</b></p> <p>AC Motor (single phase induction motor) construction, sub assemblies, type of winding used, interpretation of name plate specifications, conventional speed control methods. Types of AC motors and their applications. Starting of split phase motor and three phase AC motors.</p>	<p>Dotted lines, chain lines etc. Magnifying glass.</p>	<p>Standards- definition, types- primary and secondary standards, working standards, Standards of length, mass, time, current, voltage.</p>
5	<p>Identify and Test Permanent Magnet DC motor Identify and Test Brushless DC motor Identify and Test stepper motor Identify and familiarize with</p>	<p>DC Motor construction, sub assemblies, commutators, carbon brushes, interpretation of name plate specifications, conventional</p>	<p>Atomic Structure, Different components.</p>	<p>Ohms law: Current, voltage, resistance, and related</p>

	<p>various types of fuses with their bases. Trip a MCB by simulating fault conditions and Reset the MCB. Measure the current drawn by the motor and speed using a TACHO. Connect a DOL starter and run the given AC motor Identify the terminal connections of the ceiling Fan(permanent capacitor motor). Connect, set proper direction of rotation and Run.</p> <p>Remove the ceiling Fan motor and test it Remove the Fan capacitor and test it.</p>	<p>speed control methods and applications. Types of DC motors and their applications. Overload Relay, Fuse ratings, types of Fuses, Fuse bases, single/three phase MCBs, single phase ELCBs.</p> <p>Types of Contactors, contactor coils and working voltages, contactor contact currents, protection to contactors and high current applications.</p>		<p>problems, multiple and submultiple s units, electric power, power dissipation in resistance, power formulas.</p>
6	<p>Identify Resistors of different types(include NTC, PTC, W/W, Log, Linear, preset, VDR, LDR ) values and power ratings. Use colour code to identify the Resistors and values. Measure with multimeter the Resistance, current and voltage through series and parallel connected resistor networks Identify different inductors, test and measure the values. Apply AC and DC to RL circuit and observe the response. Identify, Test and measure capacitance of various capacitors. Monitor RC ckt behavior by applying different voltages and frequencies Measure Time constant for different values of R and C. Measure the V, I of a RLC series and parallel ckts at resonant frequencies. Find the resonant frequency of the given RLC ckt. Measurement of inductance, capacitance and resistance with L.C.R. Bridge</p>	<p>KVL &amp; KCL with applications. : Resistor -definition, types of resistors, their construction &amp; specific use, color-coding, power rating, Equivalent Resistance of series parallel ckts. Distribution of V &amp; I in series parallel ckts. Principles of induction, inductive reactance, Types of inductors , construction, specifications and applications(energy storage concept). Self and Mutual induction. Behaviour of inductor at low and high frequencies. series and parallel combination, Q factor, Electromagnets, Solenoids &amp; relays construction &amp; its application. Capacitance and Capacitive Reactance, Impedance. Types of capacitors, construction, specifications and applications. Dielectric constant. Significance of Series parallel connection of capacitors. Capacitor behavior with AC and DC. Concept of Time constant of a RC ckt. Concept of Resonance and its application in RC,RL &amp; RLC series and parallel ckts.</p>	<p>Reading of simple drawing, free hand sketching of simple solids with dimensions.</p>	-do-
7	<p>Identify Si and Ge diodes Record any ten Diode component numbers (both Si &amp; Ge) from Data book with their specifications.(I<sub>f</sub>, PIV and forward voltage drop)</p>	<p>Semiconductor component number coding for different electronic components such as Diodes, Zeners, Transistors, FETs, MOSFETs, IGBTs.</p>	<p>Free hand sketch of solids viewed perpendicularly to their</p>	<p>Series circuits: Total resistance, same current in</p>

	<p>Identify any five different packaging styles of Diodes with respective heat sinks</p> <p>Response of a Diode for different AC and DC voltages</p> <p>Test the PIV and Forward current of the given diode</p> <p>Construct and test Diode as a half wave, full wave and Bridge rectifier. Connect a capacitor to the rectifier ckt and filter the output Observe on CRO the ripple from rectifiers by varying load and filter capacitance</p> <p>Identify and Test Zener diode, Varactor diode, tunnel diode. Construct and test zener based voltage regulator circuit and test.</p>	<p>PN Junction, Forward and Reverse biasing of diodes, Interpretation of diode specifications</p> <p>Forward current and Reverse voltage, packing styles of diodes. Diode Bridge Modules. Rectifier configurations, their efficiencies, Filter components and their role in reducing ripple. Working principles of Zener diode/specifications/applications</p> <p>Varactor diode /Tunnel diode/ specifications with applications.</p>	<p>surface and axes.</p>	<p>series circuits, IR voltage drops, Sum of IR drops equal to the applied voltage.</p>
8	<p>Identify PNP and NPN Transistors.</p> <p>Record any ten Transistors numbers (both NPN &amp; PNP) from Data book with their specifications.( <math>\beta</math>, <math>V_{BE}</math>, <math>V_{CB}</math>, <math>V_{CE}</math>, <math>I_C</math>, <math>I_B</math>, Junction Temperature, junction capacitance, Frequency of operation, Power Rating )</p> <p>Identify any five different packaging styles of Transistors with respective heat sinks</p> <p>Measure E-B, C-B &amp; C-E terminal resistances and infer.</p> <p>Wire a circuit using a switch to turn on a Relay via Transistor (use Relays of different coil voltages and Transistors of different <math>\beta</math> )</p> <p>Construct a Transistorized amplifier and amplify a small signal. Vary the gain by changing the circuit components Calculate input impedance and output impedance of the constructed amplifier.</p>	<p>Construction, Working of a PNP and NPN Transistors. Purpose of E,B &amp; C Terminals. Flow of currents into and out of terminals of PNP/ NPN Transistors and their relations. Significance of <math>\beta</math> of a Transistor.</p> <p>Need for Biasing of Transistor junctions</p> <p>Interpretation of main parameters of a Transistor. <math>V_{BE}</math>, <math>V_{CB}</math>, <math>V_{CE}</math>, <math>I_C</math>, <math>I_B</math>, Junction Temperature, junction capacitance, Frequency of operation, Discuss a Transistor application as a switch. Discuss a Transistor application as an amplifier. Define input impedance and output impedances.</p>	<p>Electronic Component symbols, Series circuit, Representation of IR voltage drops.</p>	<p>Polarity of IR voltage drops, Total power in series circuits, related exercise.</p>
9	<p>Identify any five FET Transistors and record main parameters from the Data book</p> <p>Test the given FET (at least 5 no's) and record the impedances. Construct and test a FET Amplifier</p> <p>Identify SCRs of different ratings by their number. Test different SCRs (at least 5 no's) for healthiness</p>	<p>Construction of FET, differentiate it with BJT. Purpose of Gate, Drain and source terminals and voltage/current relations between them. Amplification factor of FET. Impedances between various terminals. Interpret the main parameters of the FET. Suitability of FET</p>	<p>Free hand sketches of nuts with dimensions from samples. Circuit s and wiring diagrams.</p>	<p>Arithmetic and geometric progression , sum of n-terms, simple calculations .</p>

	<p>using a Multimeter. Construct SCR test circuit with a small load and test. Identify different heat sinks used with various SCRs. Identify and test a DIAC(at least 3 no's) by its number. Use an RC circuit to fire and change the firing angle of SCR. Construct a circuit using DIAC as trigger device to fire SCR Identify and Test a UJT by its number Construct UJT based free running oscillator and change its frequency. Identify and test a DIAC(at least 3 no's) by its number Construct a circuit using DIAC as trigger device to fire TRIAC for phase control application. Identify and test a power MOSFET (at least 3 no's) by its number Identify different heat sinks used with various power MOSFET devices. Construct MOSFET test circuit with a small load and test Identify and test a IGBT (at least 2 no's) by its number Construct IGBT test circuit with a small load and test.</p>	<p>amplifiers in measuring device applications. Working of power electronic components such as SCR, TRIAC,DIAC,UJT ,MOSFET and IGBT.</p>		
10	<p>Dismantle an Analog multimeter and identify components /sections and trace path for measurement of V, I &amp; R. Measure the indicator coil voltage corresponding to different measurements. Assemble and test the meter Dismantle Digital Multimeter and Identify components /ICs/sections and Trace circuit path for measurement of V, I (AC &amp; DC) &amp; R. Measure the Signal voltage to the display IC corresponding to different measurements. Assemble and test the DMM.</p>	<p>Working principle of PMMC type ammeter. Conversion of ammeter into voltmeter. Working principles and study of Block diagrams / Schematic diagrams of Analog multimeter, Digital Multimeter, Digital LCR meter.</p>	<p>Parallel circuits, Branch currents, representation.</p>	<p>Parallel circuits: Applied voltage is the same across parallel branches, Each branch current, Total current equal to the sum of the branch currents.</p>
11	<p>Identify different electrical cables of various gauges and of different insulation strength. Remove the insulation of different cables and prepare for joining Make Solder joints of different</p>	<p>Classification of cables according to gauge, core size, insulation strength, flexibility etc</p>	<p>Explanation of simple orthographic projection 3<sup>rd</sup> angle.</p>	<p><b>-do-</b></p>

	<p>cables Make Lug joints of different Electrical cables</p> <p>Identify at least 12 different type of cables (including FRC) used in electronic industries.</p> <p>Identify at least 12 different type of cable connectors used in electronic industries</p> <p>Solder/crimp/terminate at least 10 connectors to the respective cables and test for continuity as per the marking on the connectors.</p>			
12	<p>Practice with cable ties, ferrools, routing of cables etc. Identify and familiarize with spst, spdt, dpdt, tumbler, toggle, piano type electrical switches</p> <p>Identify and familiarize with electronic pushbutton (NO, NC), with and without indicator lamps, with auxiliary contacts of different sizes</p>	Different electrical cables and their specifications	Types of resistors, colour coding, tolerance representation,	Resistance in parallel circuits, Total power in parallel circuits, effect of open branch, short circuit across parallel branches, related exercise.
13	<p>Select a soldering gun and practice soldering of different electronic active and passive components/digital ICs on varieties of PCBs.</p> <p>Join the broken PCB track and test.</p> <p>Desolder the soldered component and clean the surface of the track.</p>	Different type of soldering guns, relate temperature with wattages, types of tips. Solder materials and their grading. Use of wax and other materials. Selection of a soldering gun for specific requirement. Soldering and Desoldering stations and their specifications.	Explanation of simple orthographic projection 3 <sup>rd</sup> angle.	Temperature, pressure. Newton's law of motion, applications, momentum. Simple problems
14	<p>Measure logical high and low for TTL and CMOS ICs.</p> <p>Identify by the number and Monitor the clock frequency of different crystal ICs on CRO and measure it. Identify different Logic Gates (AND, OR, NAND, NOR, X-OR, X-NOR, NOT ICs) by the number printed on them and draw I/O pin-out numbers. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. Use NAND Gates to realize an OR operation</p> <p>Use NAND Gates to realize a NOR operation Use NOR</p>	<p>Difference between analog and digital signals, logic levels of TTL and CMOS</p> <p>Introduction to Digital Electronics, Number systems and codes Digital code: binary, octal, Excess 3 code, grey code, BCD code, ASCII code and code conversions</p> <p>Logic Gates and their truth tables, propagation delay, power dissipation and noise immunity Logic families like TTL/CMOS and sub families and their comparison.</p> <p>Availability of logic gates in multiple numbers in a</p>	Moving coil meter, Moving Iron meters, voltmeter, Ammeter, Ohm meter.	Series-Parallel circuits: Finding Total resistance for series-parallel resistances, Wheatstone's bridge.

	Gates to realize an AND operation Use NOR Gates to realize a NAND operation	package with examples. Combinational logic circuits such as AND-OR Logic, AND-OR invert Logics Universal property of NAND and NOR gates. Study different IC Packages		
15	Wire and illuminate LEDs of different sizes and observe the current drawn. Expose LDR different lights and Record the variation in resistance. Expose Photovoltaic cell to different lights and Record the variation in Voltage produced. Wire a photo Diode based circuit and switch a lamp load. Wire a photo Transistor based circuit and switch a lamp load. Identify an IRED coupled to photo Transistor (Optocouler) and operate a Relay by connecting a switch to input.	IR LEDS, Photo diode for photo transistor, its characteristics and application, optical sensor, opto-couplers, circuits with opto isolation, characteristics of LASER diodes	-do-	Resistor types, their colour codes and tolerance, series and parallel combination of resistors, power rating of resistors.
16	Construct and test voltage divider bias Construct and Test a common emitter Amplifier Construct and Test common base amplifier Construct and Test common collector amplifier Construct and Test Darlington amplifier.	Transistor biasing circuits and stabilization techniques. Voltage amplifiers- voltage gain, loading effect. configuration of common emitter, common base, common collector transistor, their definition characteristics and application	Explanation of simple orthographic projection 3 <sup>rd</sup> angle.	-do-
17	Construct and test Class A amplifier. Construct and test Class B amplifier Construct and test Class A B push pull amplifier Construct and test a single stage CE amplifier with and without emitter bypass capacitor.	Classification of amplifiers according to frequency ,mode of operation, methods of coupling. CE,CB,CC amplifier circuit and their characteristics Alpha ,beta, voltage gain, Concept of dB, dBm	Different types of series parallel circuits, representation of nodes, etc.	Static and dynamic friction. Gravitational forces. Force-definition, units, and fractional, forces.
18	Construct an emitter follower, RC coupled amplifier Construct and test push pull power amplifier Construct and test oscillator using a HF transistor. Construct and test RC Phase shift oscillator	Distinguish between voltage and power amplifier Types and effect of negative feedback in amplifiers Working of emitter follower circuit and its advantages different packages styles of transistors, in-circuit testing of transistor introduction to positive feedback and requisites of an oscillator	-Do-	Problems on force and frictional forces.
19	Construct and test as table multivibrator circuit Identify and test Transistors of different	Types of multivibrators and study of circuit diagrams Transistor power ratings &	Familiarization and sketching the	Voltage dividers, & current

	packaging styles Identify and pick a suitable heat sink for Transistors of different packaging styles Test various analog electronic components using linear IC Tester.	packaging styles, use of different heat sinks. Study of a Linear IC Tester	details of components	dividers:
20	Construct and Test Half Adder circuit and verify the truth table. Construct and Test Full adder and verify the truth table. Construct the Adder cum Subtractor and verify the result Construct and Test a 2 to 4 Decoder and test Construct and Test a 4 to 2 Encoder and test Construct and Test a 4 to 1 Multiplexer and test Construct and Test a 1 to 4 DeMultiplexer and test	Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders. IC 7482 as 2-bit and four bit full adders. Magnitude comparators. Half adder, full adder ICs and their applications for implementing arithmetic operations Basic Binary Decoder and four bit binary decoders. ICs 74LS138 and 74154 pin details and functionality. BCD to Decimal decoder. Decimal to BCD Encoder, IC 74147 details and functionality. Need for multiplexing of data and IC 74151 AS Data selector/Multiplexer. 1 to 4 line Demultiplexing. IC 74154 as a Demultiplexer.	Use of drawing instruments, 'T' square, drawing board, construction of simple figures & solids with dimensions.	Series voltage dividers, current divider with two parallel resistances.
21	Construct and test four bit latch using 7475. Identify different Flip-Flop (ICs) by the number printed on them. Verify the truth tables of Flip-Flop ICs (D,T,RS,JK) by connecting switches and LEDs Identify & Wire a Master-Slave Flip-Flop and Test the truth table. Familiarization with front panel controls and display system of Digital IC Tester Testing of : TTL , CMOS ,Memory Peripheral ICs	S-R Latch, Gated S-R Latch, D- Latch. Flip-Flop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop Clocked Flip Flop, Master-Slave flip flops and Timing diagrams Basic flip flop applications like data storage , data transfer and frequency division.  Specifications and block diagram , Operation of a Analog IC Tester and its Circuit description (in brief	Use of different types of scales in inch & millimeters, lettering numbers & alphabets. Symbols, Cells, batteries, series, parallel, representation, Magnets, Electromagnets, symbols.	Direct-current meters: Moving coil meter, design of voltmeter, ammeter, loading effect of voltmeters, related problems.
22	Construct and test a four bit asynchronous binary counter using 7493. Connect 7493 as a modulus-12 counter. Construct and test a four bit Synchronous binary counter using 74163. Construct and test synchronous Decade counter. Construct and test an up/down synchronous decade counter	Basics of Counters. Two bit and three bit Asynchronous binary counters and decade counters with the timing diagrams. 3- bit Synchronous counters and synchronous decade counters.  BCD display, BCD to decimal decoder. BCD to 7 segment display circuits		Complex numbers. Simple problems

	using 74190 and monitor the output on LEDs. Display the count value on seven segment display using decoder/driver ICs.			
23 & 24	Construct the shift register using RS/D/JK flip flop and verify the result Construct and test four bit SIPO register Construct and test four bit PIPO register Construct and test two digit Seven segment LED / Decoder-Driver circuits. Construct and test of Dotmatrix / LCD Displays. Construction and testing of Binary weighted and R-2R Ladder type Digital-to-Analog Converters. Familiarization with various types of Memory ICs Identification of Flash Memories of various capacities. Test various digital ICs using digital IC Tester.	Shift Register functions, Serial to parallel and vice versa, Parallel to parallel and serial to serial, Bidirectional shift registers, Timing diagram ,important applications.pin details and functionality of universal shift register IC 74194  Memory concepts, types of memories RAM/ROM/EPROM/FLASH PROM etc. and their applications.  Study of a Digital IC Tester : Specifications & Block diagram , Operation and circuit description of a Digital IC Tester.		Work, power and energy- definition, units, and simple problems and on shop floor practices. Conservation of momentum and energy.
25	Project work / Industrial visit(optional)			
26	<b>EXAMINATION</b>			

**TRADE: "Mechanic Computer Hardware"**

(Duration : 6 Months)

**SECOND SEMESTER.**

(Semester Code No. MCH-02)

Week no.	Trade Practical	Trade Theory	Engg. Drg.	Workshop Cal. & Science
1	Construct RC circuit and measure the Time constant by measuring voltages. Construct and test a simple high pass RC circuit and observe the integrated output for applied input. Construct RC differentiator circuit and convert Triangular wave into square wave. Construct simple diode based shunt clipping circuits to clip below and above reference voltages.	Time constants of RC & RL circuits. Diode shunt and series clipper circuits and clamping/limiting circuits and their applications. RC based Differentiator and Integrator circuits	Drawing of various electrical circuits with B.I.S. symbols of circuits, series & parallel circuits, power transformer instrument transformer etc	Kirchoff's laws: Kirchoff's voltage & current law, Branch currents, node voltages, Mesh currents, related problems.
2	Construction and testing of various Op-Amp circuits like Inverting, Non-inverting and Summing Amplifiers, Differentiator and Integrator	Introduction to Differential amplifier: construction & working block diagram of Op-Amp, importance, characteristics, common-mode gain, advantages and applications. schematic diagram of 741, symbol, Non-inverting voltage amplifier, inverting voltage amplifier, , linear and non-linear applications of 741, Comparator using op-amp , other popular op-amps	AC wave form, frequency, wavelength representation, Inductors, series parallel.	Network theorems: Thevenin's, Norton's theorems, conversion of voltage and current sources.
3	Instrumentation Amplifier. Construct the comparator using OP-AMP Construct and test monostable timer circuit using IC 555 Construct and test Astable timer circuit using IC 555 Construct and test VCO (V to F Converter) using IC 555 Construct and test 555 timer as pulse width modulator.	Block diagram of 555, functional description wrt different configurations of 555 such as monostable, astable and vco operations for various application	Transformers, types, cores, types, lamination types, representation.	
4	Measure using CRO – DC Voltage, AC voltage, Period & Frequency & observe different wave forms Troubleshooting CRO Vertical Preamplifier & all other sections (a) to (c).	Study of CRO : Specifications and block diagram , Familiarization with front panel and controls of a CRO. Study of CRO circuits (a) Vertical preamp (b) Vertical Intermediate amplifier (c) Vertical Final amplifier	Free hand sketching of plan & elevation of simple objects.	Moment of inertia of simple shapes like disc, cylinder & sphere.

5	Troubleshooting CRO Vertical Preamplifier & all other sections (d) to (f). Familiarize and doing measurement using Digital storage oscilloscope Interfacing DSO with a PC (IEEE)	(d) Time base circuits, (e) Horizontal Final amplifier (f) Low voltage & EHT power supply circuits. Study of H V circuits Digital storage and IEEE interface of a oscilloscope. Trouble shooting procedure of a CRO.	Free hand sketching of Hexagonal bar, sq. bar, circular bar tapered bar hollow bar etc.	Batteries: Cells & Batteries, Series and parallel cells, related exercise,
6	Identify and test DIODE/SCR Power bridge Identify and test MOSFET Power bridge Identify and test IGBT Power bridge Connect the heat sinks to the above power bridges	Power MOSFET, IGBT - their types, characteristics, switching speed, power ratings and protection	Capacitor structure, symbol, types, colour code, Variable capacitors	Logarithm definition, properties, simple problems.
7	Construct and test a lamp dimmer /fan regulator circuit Construct a flashing lamp circuit using a thyristor Construct a UJT based Time delay circuit to turn on a lamp load with delay of 5 seconds Control the speed of a universal motor using a TRIAC based circuit.		Calculation of area of triangles, polygons with the aid of trigonometry.	Magnetism & Magnetic units: The magnetic field, flux, flux density, Ampere-turns.
8	Identify different fixed +ve and -ve voltage regulator ICs of different current ratings ( 78/79 series) along with i/o, reference pins. Wire a fixed voltage regulator as a variable one by floating the reference. Identify proper heat sinks for different IC based voltage regulators. Vary the input voltage and observe the fixed output for the above mentioned series Construct a dual power supply using above regulator ICs with current limiting and short circuit features.	Regulated Power supply using 78XX series, 79XX series, Op-amp regulator, 723 regulator , (Transistorized & IC based) voltage regulation, error correction and amplification etc.	Series RLC, Parallel RLC circuits.	Angular momentum & torque simple problems.

9	<p>Identify different front panel controls and connectors of the given power supply.</p> <p>Test the given power supply and limit the output for a specific voltage and current.</p> <p>Open the power supply and identify major sections and power components with heat sinks. Test the semiconductor power switches of a power supply.</p> <p>Operate a programmable power supply and test its features</p>	<p>Specifications &amp; block diagram of Linear power supplies.</p> <p>Front panel controls and features of various power supplies.</p> <p>Different types of power switches and heat sinks used in power supplies.</p>	<p>Symbols as per different semiconductor devices- LDR, VDR.</p>	<p>Alternating voltage and current: AC fundamentals, RMS, Average values.</p>
10	<p>Dismantle the given stabilizer and find major sections/ ICs/ components.</p> <p>Measure voltages at vital points.</p> <p>Identify various input and output sockets/connectors of the given SMPS.</p> <p>Apply input and measure outputs using a multimeter.</p> <p>Test capacity of the given SMPS.</p> <p>Identify major sections/ ICs/ components of SMPS.</p> <p>Measure / Monitor major test points of SMPS.</p> <p>Identify and replace the faulty components.</p> <p><b>Use SMPS used in TVs and PCs for practice</b></p>	<p>Manual &amp; automatic and servo voltage stabilizers- concept and block diagram, o/p voltage adjustment, voltage cutoff systems, study of different types of relays used in stabilizers, study of electronic circuit commonly used, buck and boost concept</p> <p>Block Diagram of Switch mode power supplies and their working principles.</p> <p>Principles of Inversion and Inverter circuits using different techniques.</p> <p>Pulse width modulation and their applications.</p>	<p>Thermistor &amp; their use in circuits.</p>	<p>Frequency, time period, wavelength, related problems.</p>
11	<p>Construct and test step up type chopper circuit</p> <p>Construct and test step down type chopper circuit</p> <p>Construct and test inverter type chopper circuit</p> <p>Construct and test IC Based DC-DC converter for different voltages</p>	<p>Various types of chopper circuits step-up, step down, inverting types.</p> <p>Introduction to DC-DC Converters</p> <p>ICs used for converting DC-DC , block diagrams and their pin outs. Applications of DC-DC converters</p>	<p>Diodes, Forward &amp; Reverse bias.</p>	<p>Areas of rectangle, circles, regular polygons, calculation of areas.</p>

12	<p>Identify various input and output sockets/connectors /indicators on the given UPS. Make individual connections between batteries of battery stack and test for healthiness of batteries on stack. Connect battery stack to the UPS. Make load test to measure backup time</p>	<p>Electrical wiring for Single phase and Three phase systems, Earthing and earth resistance measurement, calculation of load power and power factor of a power source.</p> <p>Review on Batteries – various types, their selection, grouping of cells and batteries, charging of batteries, Various Battery charging circuits used in Inverters and UPS , Maintenance of Batteries Inverter – their principle &amp; operation, power rating, change over period. Installation of Inverters, Protection circuits used in inverters– battery level, over load, over charging etc. Various faults and its rectification</p>	Rectifiers, Input & output waveforms.	Volumes & weight of simple solids, cubes, hexagonal prism. Shop problems
13	<p>Identify isolator transformer, inverting transformer and control transformers. Adjust charging current according to number of batteries. Identify various circuit boards and monitor voltages at vital test points. Identify the charging section and set the charging current according to backup. Identify the semiconductor power modules and measure voltages. Perform a load test to UPS.</p>	<p>Types of UPS. Block diagram and working principle of different types UPS. Specifications of a typical UPS. Most frequently occurring faults and their remedies.</p> <p>Concept of UPS, OFF LINE and ONLINE . Difference between Inverters and UPS. Selection of UPS – calculation of load power, Line interactive UPS ON- Line UPS, their circuit description and working- controlling circuits, Micro controller circuits, power circuits, charging circuits, alarm circuits, Indicator circuits</p>	Regulator circuits, Clipper circuits, wave forms.	Inductance: Inductance, mutual inductance, transformer, Inductances in series and parallel, Impedance, related problems.
14	<p>Identify and draw different active, passive components using symbols</p> <p>Draw schematic diagrams for basic analog circuits</p> <p>Draw schematic diagrams for basic Digital circuits</p> <p>Draw schematic diagrams for Microprocessor and Microcontroller based circuits</p>	<p>Identify different active, passive components using symbols</p> <p>Draw schematic diagrams for basic analog circuits</p> <p>Draw schematic diagrams for basic Digital circuits</p> <p>Draw schematic diagrams for Microprocessor and Microcontroller based circuits.</p>	Drawing of A.F. amplifiers circuit.	Concepts of elasticity & elastic limits, stress & strength, Hooke's law, young modulus of elasticity, applications in plant

15	Identify foot prints for different analog /digital electronic ( lead and SMD) components Prepare layouts for simple analog/digital circuits Generation of output prints for fabrication (topside / bottom side / solder mask )	Identify foot prints for different analog /digital electronic ( lead and SMD ) components Prepare layouts for simple analog/digital circuits Generation of output prints for fabrication (topside / bottom side / solder mask )	Drawing of A.F. amplifiers circuit with stage & types of O/P.	Capacitance : Charge stored in capacitors, Farad unit and conversions .
16	Identification of 2/3/4 terminal SMD components Soldering / dsoldering of above components Identification of PGA packages Soldering / Desoldering of above PGA components Cold/Continuity check of PCBs Identification of lose /dry solders, broken tracks on printed wiring assemblies.	Identification of 2/3/4 terminal SMD components Soldering / desoldering of above components Identification of PGA packages Soldering / Desoldering of above PGA components Cold/Continuity check of PCBs Identification of lose /dry solders, broken tracks on printed wiring assemblies	P-p. Symbols of transistors, CB, CE, CC configurations, biasing circuits.	Capacitor colour coding, Series and parallel capacitance s, Capacitive reactance, Impedance.
17	Familiarize with the Microprocessor kit, identify different ICs on the kit. Observe the voltage/ waveforms on different ICs and IC pins of the processor Monitor the clock frequency. Write down the address range of different memory IC s and peripheral ICs on the kit. Enter data to different memory locations in RAM Enter simple programs and execute using assembly language	Intro to 8085 Microprocessor Architecture, pin details and Bus System of the processor. Function of different ICs such as decoders, buffers, latches etc used with 8085 processor	Block diagram of an oscillator.	Simple problems on stress in bars. Concept of share modulus, bulk modulus & poisson's ratio.
18	Use assembler to assemble the programs and load them for execution by the processor Program to Blink an LED using port pins of 8255. Program to Control a relay using the port pins of 8255. Program to read the data from memory to sequentially ON the LEDs	Interfacing to memory ICs RAM, PROM/EEPROM Interfacing different peripheral ICs such as 8255. Instruction set covering data transfer, logical, Arithmetic , serial communication etc.	Symbols for different wave shapes.	Resonance: Series resonance, Parallel resonance circuits, Resonance frequency, related exercise.

19	Write the RAM and ROM address ranges (internal and external) of the given Microcontroller kit. Enter data into specific RAM locations and observe the volatility. Practice different commands to enter/edit and execute Assembly programs Identify different ICs used in the given Microcontroller kit and test vital signals on the ICs.	Differentiate Microprocessor and Microcontroller, Architecture of 8051 family of Microcontrollers, pin diagram and various on chip resources . Types of memory with 8051 such as On chip, external code memory, External RAM .	Symbols for different wave shapes Sq., saw tooth.	AC circuits: Power, VA, KVA, Watts, KW, related exercise, power factor.
20	Differentiate Microprocessor and Microcontroller, Architecture of 8051 family of Microcontrollers, pin diagram and various on chip resources . Types of memory with 8051 such as On chip, external code memory, External RAM .	Register Banks and their use Memory mapping of the microcontrollers, bit addressable registers (bit memories). Instruction set and various types of instructions	Symbols for different sine, triangular etc.	Concept of shear forces, bending moment, torsion in shaft, simple problems.
21	Use the timer as an event counter to count external pulses. Execute a program to flash a set of 4 LEDs connected to port pins on the kit Write a program to use on board ADC and convert the analog voltage signal into digital value and store it memory	Special function registers (SFRs) and their configuration for various applications. Input / output ports and their configuration. Implementation of various Timer and counting functions, aspects of serial communication, Utilization of onchip resources such as ADC etc. Assembly software and compilers for 8051 Microcontrollers. 8052 and its difference with 8051	Single stage amplifiers, Multistage amplifiers.	Diodes: Rectifier, peak voltage, PIV, Rectifier efficiency.
22	Cutting, cleaning and preparing of fiber cable for splicing Splicing of OFC using splicing machine.	Intro to optical fiber as a transmission media, its advantages over other media. Working principle of transmitter and receiver in fibre optic communication. Pplications and advantages of fibre optic communicaoitn.	Class 'A', Class 'B', Push pull, Complimentary symmetry circuits.	Voltage regulators, Voltage doublers, multipliers, Clipper circuits, related exercise.

23 & 24	<p>Testing of OFC using OTDR</p> <p>Measure propagation, return and bending losses etc.</p> <p>Measure optical signal power using optical power meter</p> <p>Test the optical fiber cable using Visual Fault locator</p> <p>Make optical fibre setup to transmit and receive analog and digital data.</p>	<p>Properties of optic fibre, testing, losses , types of fibre optic cables and specifications</p> <p>Encoding of light</p> <p>Fibre optic joints, splicing, testing and the related equipments/measuring tools, precautions to be taken</p> <p>laying of cables, safety aspects while handling optical cables</p>	<p>Oscillators circuits, Multivibrators, UJT oscillator, FET, MOSFET symbols, DIAC,TRIC</p>	<p>Transistors: Biasing of transistors, CB, CE, CC, DC &amp; AC Load line , operating/ 'Q' point, problems.</p>
25	Project work / Industrial visit(optional)			
26	Examination.			

**TRADE: "Mechanic Computer Hardware".**

(Duration : 6 Months)

**THIRD SEMESTER**

(Semester Code No. MCH-03)

Week no.	Trade Practical	Trade Theory	Engg. Drg.	Workshop Cal. & Science
1	Identification of ports, connectors and cables. Checking system configurations and specifications, assembling / disassembling procedures.	PS/2, Serial, Parallel, USB, SCSI, RJ-11, RJ-45, Audio, IrDA, Wireless, SVGA, DVI, HDMI, HDI, Joystick and MIDI. Motherboard components, bus types in pc, form factors, chipsets,	Drawing of AM&FM.	Power transmission by shaft, belts & ropes
2	Processor cooling solutions, BIOS setup, Installation: Single boot/multi-boot systems, their configurations, identification and testing and troubleshooting of computer memory, memory up-gradation,	Processor: specifications, features, manufacturing, sockets and slots, Multicore processors, operating voltages;	Modulated wave at various modulation 100 pc., 50 pc etc.	Transistor amplifiers, Voltage Gain
3	Installation and configuration of storage devices. Integration of PATA and SATA drivers.	Installation / Uninstallation, Installation of devices/device drivers. Storage devices: magnetic optical and flash drive technologies,	<b>-do-</b>	Current gain, power gain, decibel.
4	Memory identification, display system troubleshooting, Power supply testing and replacing, Display system maintenance and troubleshooting, Monitor problem diagnostics and repair, BIOS using flashing.	Computer memory: types and identification, memory modules, display technologies: CRT, LCD, Plasma and LED, Touch screens, PC Video hardware, HD graphics, PC Audio hardware, pc power supply, PC BIOS.	Logic gates, Combinational gates, other circuits.	<b>-Do-</b>
5	Installation and configuration of disk drivers, jumper setting, installation of SATA drivers, configuring bios for ATA/AHCI mode, setting up PATA and SATA drives together, partition and formatting, installation of single/multi boot Section	PC Drive technologies, PATA, SATA, SCSI, construction and working principle, Disk geometry: Heads, tracks, cylinders and sectors, seeks and latency, data transfer rate, cache, BIOS, OS and interface limitations, modern ATA standards.	<b>-do-</b>	Oscillators, Frequency calculations.
6	Data recovery of flash drive, formatting drive. Making flash driver bootable, installation of operating system, Making live installation on disk.	Working of flash memory, storing / reading data, Types of flash memory devices: BIOS chip, Compact Flash, Smart Media, Memory Stick, Multimedia Card, Secure Digital Card, Flash USB drive, PCMCIA flash	Exercise on blue print reading/ circuit.	Relaxation oscillator problems, related exercises.

7	Installation and configuration CD and DVD drives, lens cleaning using toolkits, maintenance: do's and don'ts, troubleshooting, installation of Blue-ray drive, Repair of optical drives.	Optical drive technologies, installation and configuration CD and DVD drives, Types of CDROM, DVD ROM, working principal, writing-rewriting data on disk, compatibilities issues, Blu-Ray disks and drivers, optical driver electronics.	<b>-Do-</b>	Concepts of lifting machine, velocity ratio.
8	Server: Installation, configuration and troubleshooting, configuring various RAID configurations.	Server hardware: types: Tower, Rack mount and Blade, Motherboards, expansion slots, memory, Server Processors. Concept of RAID on server.	Reading of house service connections.	Mechanical advantage, relation between them.
9	Diagnostics and fixing of basic problems in printers using software and hardware utilities. Paper jams, toner drum problems, cleaning procedures, Common problems and solutions. Basic scanner maintenance, care of scanner, scanning images, documents, conversions of documents.	Printer technologies: impart, non-impact, thermal, laser inkjet, multifunction devices, working principal, printer interfaces, scanner technology, interfaces, scanner types, scanner specifications: resolution, color depth, interface, paper size, document conversion using scanner.	Reading of house service connections & small power circuits,	<b>-Do-</b>
10	POST codes and their meaning, fixing of problems based on codes.	Power on self test, Peripheral diagnostics, general purpose diagnostics, Operating system diagnostics. Hardware boot process, Windows boot process.	-do-	Digital Electronics: Binary numbers.
11	Practice on use of hand tools, observation of safety during pc handling.	Hand tools, safety, test equipments, special tools	Connections of ammeter.	Binary arithmetic, Basic logic gates.
12	Practice on preventive maintenance procedures, use of windows system tools like Disk cleanup, disk defragmenter, system restore, backup and scheduled tasks.	Active preventive maintenance procedures, passive maintenance procedures.	-do-	<b>-do-</b>
13	Detecting problems using bios beeps and fixing them, fixing of OS installation problems, configuration and troubleshooting of bios.	Diagnostics of problems in hardware, operating system installation, BIOS, reinstall/replace, troubleshooting by parts replacing, bootstrap approach, hardware problems after booting, software problems, adapter card problems.	Connections of voltmeter.	Binary arithmetic, & other logic gates.

14	Practice on assembling and disassembling of laptop, up gradation of memory,	Laptop basics, laptop architecture, difference between portables and desktops, Motherboard, Processor, BIOS, Memory, Drives,	Connections of KWh-meter with ISI symbols.	<b>-do-</b>
15	Hard disk devices, configuration of bios for operating system support, Carrying out laptop maintenance.	Power supplies and cooling, Batteries and Ac adapters, Video display, audio, Card bus and PC card components, Memory card readers, Installation of device drivers in a laptop,	-Do-	Vector – definition of scalar.
16	Enabling support for SATA technology. Installation of OS using SATA technology drivers. Laptop troubleshooting	Input system: Touchpad, Trackball, Track point, Docking station, Upgrade memory, hard disk, replacing battery, Configuring wireless internet in a laptop,	Connections of circuit.	Vector – definition of scalar and vector, notations.
17	Use of windows system tools for pc maintenance, use of free/open source tools for system troubleshooting / maintenance, Clearing CMOS password, monitoring motherboard and CPU temperatures, recovery of ms office doc passwords, handling common keys in registry, use of data recovery tools,	Concept of magnetic storage, de-fragmentation, restore point, back and cleanup, getting system information, CMOS storage concept, motherboard and CPU temperature sensors, storage of office suite passwords, concept of system registry,	-Do-	Representat ion of vectors.
18 & 19	data recovery in flash drive, windows system recovery options, system repair using console commands, extending activation period of windows, improving performance by setting virtual memory, use of system file checker for restoring corrupt files, use of Dr. Watson utility for logging and troubleshooting,	concept of data recovery, flash drive storage concepts, windows system repair concepts, commands to recover system from command prompt, creating password reset disk, activation of windows, virtual memory in windows, restoring corrupt files	Connections of circuit & Reading.	Digital Electronics: Combined logic gates.
20	Hands-on on creation of various types of live CDs, creating and managing windows / linux partitions, installation of windows on SATA drive,	use of live installations / CDs for recovery / troubleshooting, preparation of live CDs, slipstreaming of service packs, drivers, creating boot cds, windows partitions	Drawing of different stages of R/R/.	Digital Electronics.
21	Downgrading windows vista to windows XP, creating and restoring images of partitions and drives, use of linux based system rescue CDs, creating unattended installation of operating system, recovery of forgotten passwords in windows.	SAGTA driver concepts and operating system compatibilities, concept of software imaging, understanding windows password storage techniques.	<b>-Do-</b>	Other digital circuits.

22	Installation and configuration of antivirus software, staying up-to-date, virus symptoms, scanning for viruses and removing them.	What is virus, types: file, boot sector, macro, stealth, worms, web applet, techniques of attach: polymorphic, multipartite, stealth, Trojan, time bomb and logic bombs, Adware and Spyware.	<b>-Do-</b>	<b>-do-</b>
23	Installation of virtual machines inside host systems, configuration of networking with resource sharing.	Storage and Optical drives, USB3, SATA6, solid state devices, cloud computing, desktop and server virtualization	Free hand sketches of trade objects.	Addition and subtraction of vectors.
24	configuring hardware devices and setting up networking between virtual machines	cloud computing, desktop and server virtualization	<b>-Do-</b>	Scalar and cross product. Simple problems
25	Project work / Industrial visit(optional)			
26	<b>Examination.</b>			

## TRADE: “Mechanic Computer Hardware”

(Duration : 6 Months)

### FOURTH SEMESTER

(Semester Code No. MCH-04)

Week no.	Trade Practical	Trade Theory	Engg. Drg.	Workshop Cal. & Science
1	Identification of network topologies, network devices, types of protocols used, types and network media used. Use of PoE devices.	Network Architecture, peer-to-peer and client/server, Network types, Topologies, Network protocols, OSI Layers, Network Models, Network Components, Power over Ethernet Devices (PoE), Network configuration.	Block diagram of different network and network devices. Schematic diagram of network models with different configuration	Calculation of cost of hardware devices. Finalization of estimate.
2	Prepare cable terminations, Assemble modular outlets, Prepare straight and cross UTP cable and test, practice on splicing, termination using OTDR, Patch panel termination.	Network medias, Media specifications and standards, Types of cables used, Cable preparation and testing with special stress on fibre optic cables preparation and testing, Cable length limitations.		
3	Installation of Network Operating system and basic network configuration.	Differences between Desktop Operating system and Network Operating System (NOS). Essential features of NOS. Examples of NOS.		
4	Installation of network protocols and test them one-by-one. Assigning IP addresses and testing the connections using ping command.	Function of protocol and protocol family, TCP/IP protocol suit, FTP, Telnet and SSH, concept of multi-homed computers.	Exercise on blue print reading/ circuit. Reading of house service connections & small power circuits,	Introduction to trigonometry Trigonometric ratio.
5	Installation, configuration and testing of these protocols.	NetBEUI, UDP,FTP,TFTP, HTTP, ICMP and SNMP		
6	Carry out a network need analysis and identify model, Decide on topology	Design a simple network, Layer 2 and Layer 3 switching techniques, Building wiring plan		Trigonometric identities. Measurement of angles.
7	Prepare network cabling plan, Prepare layout diagram,	Cabling plan Choosing server specifications, Choosing topology, selection of protocols.		
8	Setting up of network for file, printer and internet sharing.	Concept of workgroups, setup a simple workgroup to share folders,	Introduction to types of network topology	Problems on Height and distance
9	Hiding resources, access control, setup of network between Windows XP and Windows 7	Sharing printers and single internet connection.	Different topology design concept.	

10-12	Install and configure Windows Server Configure services like Active Directory, DNS and DHCP. Configuration of broadband modem and sharing internet connection.	Server concepts, Installation steps, configuration of server. Concept of Active Directory and DNS. Setting up of DHCP, Routing and remote access.	Diagram practice on Bus, Ring Mesh Tree topology etc	Introduction to statistics. Measurement of central tendency. Introduction to histograms and pie charts.
13	Configure a DHCP server and verify IP assignment: release and renewal operations,	User Accounts Working with domain,	Practice on network topology diagram	Introduction to probability. Addition and multiplication rules.
14	Share folders and printer on network and set access restrictions,	managing domain resources	Practice on token ring network	
15	Use of network management software.	Access restrictions of network shares.		
16	Identification and installation of wireless devices like LAN cards, Access points and Routers, setup a simple ad-hoc network.	Wireless networking standards, Equipments used in wireless networking, Setting up Ad-hoc networks.	Introduction to wireless network	Problems on probability.
17	Setup of infrastructure based network, share folders, printer and internet connection,	Setup of infrastructure based wireless networks, Sharing files, printers and internet connection on network	Practice on proxy server and with networking system	
18	Setting up basic security using public keys and MAC address filters. Integrate wired with wireless network.	Collaborating using wired and wireless networks, Network security, Network performance study and enhancement.	Practice on home networking system and office automation networking system	Introduction to probability distribution and normal distribution
19	Installation, multiboot setup, configure networking, share resources and access	Windows vs. Open Source Overview of Linux OS, Shell commands,		Introduction to estimation for a set up of networking system with multi computer set up with networking server with different protocol system
20	Integrating windows and Linux environments with Samba Server.	Installation and configuration, Configuring network on Linux boxes.		
21	Setup a simple WAN, Setup routing, Visit to established WAN setup/establishment.	Introduction to WAN WAN environment and features, Network component used, Transmission technologies, Voice over data services.	Introduction to wireless router system and networking diagram of wireless set up	

22	Configuring and use of Network management and Unified Threat Management devices / software.	Network infrastructure management concepts, security loopholes, patches and their use.	Practice on hybrid network topology	-do-
23-24	Setting up of basic collaboration tool like NetMeeting for activities like chat, application sharing, remote desktop access and control, VoIP. Setup IP camera for basic surveillance scenario, logging and monitoring of devices / locations.	Surveillance using network devices, collaboration on network for team optimization and support activities. Remote management of servers / devices.		-do-
25	Revision			
26	Examination			

**TRADE : Mechanic Computer Hardware**  
**LIST OF TOOLS AND EQUIPMENT**

**A. TRAINEES TOOL KIT FOR 20 TRAINEES +1 INSTRUCTOR**

Sl.No	Specification	Quantity
1	Connecting screwdriver 100 mm	21 nos.
2	Neon tester 500 V.	21 nos.
3	Screw driver set (set of 5 )	21 nos.
4	Insulated combination pliers 150 mm	21 nos.
5	Insulated side cutting pliers 150 mm	21 nos.
6	Long nose pliers 150 mm	21 nos.
7	Soldering iron 25 W. 240 V.	21 nos.
8	Electrician knife	21 nos.
9	Tweezers 100mm	21 nos.
10	Digital Multimeter	21 nos.
11	Soldering Iron Change able bits 15 W	21 nos.
12	De- soldering pump	21 nos.

**B. LIST OF TOOLS REQUIRED**

Sl.No	Specification	Quantity
1	Steel rule 300mm	4 Nos.
2	Steel measuring tape-3 m	4 Nos.
3	Tools makers vice 100mm (clamp)	1 No
4	Tools maker vice 50mm (clamp)	1 No
5	Crimping tool (pliers)	2 Nos.
6	Soldering Iron 25W	6 Nos.
7	Magneto spanner set	2 Nos.
8	File flat 200mm bastard	2 Nos.
9	File flat 200mm second cut	2 Nos.
10	File flat 200mm smooth	2 Nos.
11	Screw driver 150mm	4 Nos.
12	100mm flat pliers	4 Nos.
13	100mm round nose pliers	4 Nos.
14	Hacksaw frame (tubular)	4 Nos.
15	Steel rule 150mm	2 Nos.
16	Scriber straight 150mm	2 Nos.
17	Soldering Iron 240W	1 Nos.
18	Hammer ball pin 0.5Kg	1 Nos.
19	Allen key set (set of 9)	2 Nos.
20	Tubular box spanner (set of 6nos)	1 No
21	Magnifying lenses 75mm	3 Nos.
22	Drill bit 5/16" (7.9mm)	2 Nos.
23	Continuity tester	6 Nos.
24	Soldering iron 10W	6 Nos.
25	Cold chisel 20mm	1 No.
26	Scissors 200mm	1 No.
27	Handsaw 450mm	1 No.
28	Hand Drill Machine	2 nos.

## **B. Tools & Equipments**

### **Tools and Equipment: (Computer Hardware: Installation and Maintenance)**

<b>Sl. No.</b>	<b>Name of the Equipment</b>	<b>Qty</b>
<b>HARDWARE</b>		
1	Server Computer (Tower Model)	01 no
2	Server Computer (Rackmount Model)	01 no
3	Desktop Computer	10 nos
4	Laptop, Notebook	01 each
5	Intel Mobile Desktop based PC with LCD monitor	01 no
6	Printers: Laser	01 each
7	Network Printer	01 no
8	Mobile Wireless Printer	01 no
9	5KVA online UPS	02 nos
10	LAN Cards	12 nos
11	LCD/DLP Projector	01 no
12	Power Meter	02 nos
13	Crimping Tools	06 nos
14	Computer Toolkits	06 Nos.
15	Computer Spares:	As required
16	Motherboards (of different make)	4 nos
17	Cabinets	4 nos
18	Processors (of different make)	4 nos
19	Hard Disk (500 GB or better)	4 nos
20	Optical Drives	4 nos
21	LCD/LED Monitors	2 nos
22	Pen Drives	4 nos
23	External Hard disk	2 nos
24	External DVD Writer	2 nos
25	Keyboards	4 nos
26	Mouse	4 nos
27	Anti static pads	4 nos
28	Anti static wrist wraps	4 nos
29	SMPS	4 nos
30	Digital Multimeters	10 nos
31	Blu-Ray drive and player	2 nos
32	External Hard Disk	2 nos
33	Tablet PC	2 nos
34	Digital Camera	2 nos
35	HD Display	2 nos
36	Network storage	2 nos
37	Card Reader	2 nos
38	Game video card	2 nos
39	Web Cam	2 nos
40	Surround sound speakers	2 nos
41	HD Digital Camcorder	2 nos
42	Different types of memory cards	2 nos each
43	Laptop kits	12 nos
44	Laptop spares: Cabinet with display, memory, hard disk, battery pack, keyboard membrane, chargers	As required
45	Microprocessor training kit 8085	2 nos
46	Microcontroller training kit	2 nos
47	SMPS Trainer kit	2 nos
48	UPS Trainer kit	2 nos
49	Power electronics Trainer kit	2 nos

<b>SOFTWARE</b>		
1	Windows Server Operating System	2 licenses
2	Windows Operating System	2 licenses
3	Linux Operating System	2 nos.
4	Network Management Software	01 No.
5	MS Office	2 nos
6	Anti virus software	2 nos
7	Data recovery software	2 nos
<b>FURNITURE and Other Equipments</b>		
1	Computer Tables	10 nos
2	Computer Chairs	20 nos
3	Printer Table	1 no
4	Class room chairs	20 nos
5	Air conditioners (optional)	2 nos
6	Scanner	1 no
7	Modem	1 no
8	Telephone Line	1 no
9	Broadband Internet connection	1 no
10	Fire fighting equipments	As required
11	Hardware and Network Trainer Kit	6 nos

### **C.Tools & Equipments**

<b>(Computer Networking)</b>		
<b>Sl. No.</b>	<b>Name of the Equipment</b>	<b>Qty</b>
<b>HARDWARE</b>		
1	Wireless Network Adapter	10 nos
2	Wireless Access Point	6 nos
3	Router	6 nos
4	Managed Layer 2 Ethernet Switch 24 port	2 nos
5	Managed Layer 3 Ethernet Switch 24 port	2 nos
8	Network Training System	2 nos
9	LAN Protocol Simulation and Analyser Software	2 nos
10	Network and Internet security trainer	2 nos
11	LAN cable tester	2 nos
12	Network cables – UTP	As required
13	Network Cables - Fibre	As required
14	LAN Cards	10 nos
15	Multimode Fibre (MMF) Cable	As required
16	Single Mode Fibre (SMF) Cable	As required
17	Cat 5E, Cat6, Cat 7 cable	As required
18	Power Meter	2 nos
19	Fibre Module – SX, LX Module	4 each
20	Media Convertor	4 each
21	24 port UTP jack panel	2 nos
22	Fibre jack panel	2 nos
23	SC Couplers	12 nos
24	SC Pigtails	12 nos
25	RJ-45 connector	As required
26	Fluke Meter	2 nos
27	Multi mode fibre (MMF) - SC-SC	4 nos
28	MMF SC-LC	4 nos

29	MMF ST-ST	4 nos
30	MMF ST-LC	4 nos
31	Single mode fibre (SMF) - ST-ST	4 nos
32	SMF SC-SC	4 nos
33	SMF SC-LC	4 nos
34	SMF ST-LC	4 nos
35	Crimping Tools	6 nos
36	Switch with POE ports	2 nos
37	POE adapters	2 nos
38	Fibre Splicing Machine	1 no
39	UTM Device for network security	1 no
40	Network Camera (Outdoor / Indoor)	2 no each