

1. Explain requirement of computer maintenance

- Troubleshooting in a computer is an intelligent and sophisticated process. Advances in IC integration have totally changed the nature of troubleshooting.
- Products should be carefully analyzed before going to troubleshooting. Success of troubleshooting is depending on:
 1. Tools and test equipment
 2. Diagnostic aids in the PC
 3. Problem solving approach
 4. Various techniques adopted in troubleshooting

2. Explain in detail Power on Self Test (POST)

- Power-on self-test (POST) is the common term for a computer, router or printer's pre-boot sequence. The same basic sequence is present on all computer architecture. It is the first of the more general process called initial program load (IPL), booting, or bootstrapping.
- When the problem is identified with the system during the POST, the BIOS will use three methods to represent the problem.

A. Beep Code: Beeping pattern on the speaker.

Example: five beep means, processor may be fail.

B. Error Code: for every error there is specific code which is describing the nature of error. This code description is provided in the specification of that BIOS manufacturer.

Example: Error Code from 100 to 199 indicates CPU related fault.

C. Detail Error Message: Brief description of the error is displayed on the screen.

Example: INTR #1 means Interrupt controller 1 failed.

The following procedure describes POST sequence:

1. Processor test

Different flags and registers within the processor are tested.

2. BIOS ROM test

The contents of the 8 k ROM containing POST and BIOS is verified by checksum calculation method.

3. Timer 1 test

The timer 1 in programmable interval timer (8253-5) is tested.

4. DMA channel 0 test:

The channel 0 of DMA controller is tested here.

5. Base 16 k RAM test

The first 16 k RAM is tested using five different test patterns are written and verified on each location of the address 00000h to 03FFFFh.

6. CRT controller test

CRT controller (6845) and the video buffer RAM in the display adapter are tested.

7. Motherboard support chips test

The interrupt controller, timer (8253) and keyboard interface are tested.

8. RAM test

RAM after the first 16 kb tested here using five different patterns.

9. Optional ROM test

The ROMs in Hard disk controller are tested by checksum method.

10. Peripheral controller test

The floppy controller, parallel ports, serial ports and Hard disk controller are tested.

At end of all the above tests, the POST passes control to the bootstrap program in BIOS. The bootstrap loader reads the initial program from track 0 on disk. This initial program reads more programs from the disk, which is nothing but the operating system.

3. Explain in detail Motherboard Troubleshooting.

- The following Tables Show the most common motherboard problems, diagnosis and their possible solution.

No .	Problem Description	Symptoms	Diagnosis	Possible Solution
1.	System Loses Time Settings. Gives Dead Battery errors CMOS Battery work only some times.		<ul style="list-style-type: none"> ✓ The battery is getting low or dead. ✓ Bad connection between the battery and the motherboard 	<ul style="list-style-type: none"> ✓ Change the CMOS battery ✓ Correct the connection between the battery and the motherboard
2.	Power cable is unplugged Defective power cable.	<p>System has no power at all Power light does not illuminate. Fan inside the supply does not turn on, and indicator light on keyboard does not turn on.</p> <p>Faulty wall outlet; circuit breaker or fuse blown.</p>	<ul style="list-style-type: none"> ✓ Visually inspect power cable. ✓ Visual inspection, try another cable. ✓ Plug device into socket known to work and test. 	<ul style="list-style-type: none"> ✓ Make sure power cable is securely plugged in. ✓ Replace cable. ✓ Use different socket, repair outlet, reset circuit breaker or replace fuse.

3.	Expansion card is partially dislodged from expansion slot on the motherboard. Defective expansion card.	System is not working. Keyboard light are on, power indicator lights are lit, and hard drive is spinning.	✓ Check all expansion cards to ensure they are securely seated in slots.	✓ Using even pressure on both ends of the expansion card, press down firmly on expansion card.
			✓ Remove an expansion card.	✓ Make sure expansion card is secure in expansion socket.
4.	Connector between hard drive and system board unplugged.	System does not boot from hard disk drive, can be booted from floppy disk drive.	✓ When attempting to run the FDISK utility gives message: invalid Drive.	✓ Check the Hard disk drive cable connection on motherboard. ✓ Check the Hard disk drive priority on CMOS setting
5.	No power to monitor.	After install an expansion card (network card, tape drive card, etc.) the system no longer work properly.	✓ All or part of the system may be inoperable. The new card may work but a mouse or COM port may not work.	✓ Change the interrupt or RAM address on the new expansion card. ✓ See the documentation that came with the new card in order to change pin settings.
6.	Incorrect CMOS setting.	Screen message says "Invalid Configuration" or "CMOS Failure"	✓ Check the configuration program.	✓ Replace any incorrect information.

7.	Hard disk drive Master/Slave jumpers wrong setting.	Cannot boot system after installing second hard drive.	✓ See manufacturer specification for Hard disk drive.	✓ Set master/slave jumpers correctly.
	Hard Drives not compatible/different manufacturers.		✓ See the Hard disk drive manufacturer and motherboard documentation	✓ Contact drive or motherboard manufactures for compatibility with other drives.

4. Explain in detail Keyboard Troubleshooting.

No.	Problem	Causes	Solution
1.	Keyboard won't respond anything	<ul style="list-style-type: none"> Plug is disconnected too or if it's a wireless keyboard, batteries are down. 	<ul style="list-style-type: none"> Check the connection or check the batteries.
2.	Receiving a keyboard error when system is boot.	<ul style="list-style-type: none"> A key being pushed down while the computer started. Something on top of the keyboard. Loose keyboard connection. 	<ul style="list-style-type: none"> Make sure you do not boot the PC with a key pressed down on the keyboard. Make sure nothing is on top of the keyboard during boot time. Make sure the keyboard is connected properly to the system.
3.	Pressing {Ctrl} + {Alt}+{Delete} keys, system does not respond	<ul style="list-style-type: none"> Any one of the key mechanism is damaged. System having virus. 	<ul style="list-style-type: none"> Individually test each of key. Open other program and pressed the keys. Scan our system with best antivirus software.
4.	One or more key on keyboard not generating a keystroke reliably or key are or misbehaving.	<ul style="list-style-type: none"> Particular key is used frequently (gaming programming) Keyboard having dirt and debris. If key internal mechanism is damaged. 	<ul style="list-style-type: none"> Clean the keyboard carefully Verify key on the other program. Change the key or keyboard.

5.	Keys are repeating	<ul style="list-style-type: none"> • BIOS typematic delay setting is not proper 	<ul style="list-style-type: none"> • Check in BIOS for a setting to control the systematic delay and increase the representing time.
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5. Explain in detail Mouse Troubleshooting

Problem	Solution
Loose Connection	<ul style="list-style-type: none"> • This is the most common problem in case of any mouse, be it a PS/2 mouse, a USB mouse or a wireless mouse (its receiver). • If you notice that the cursor is not responding to the mouse movements, check whether the connection between the mouse and the CPU has become loose. • In case of a wireless mouse, check the connection of its receiver device, if it is loose, plug it in securely. • If the mouse still does not respond, try connecting the receiver to another USB port. • If the cursor still does not respond, reboot the PC by restarting it.
Accumulation of Dirt and other Disturbance	<ul style="list-style-type: none"> • If this is the problem you will have to open the chamber, and clean it as well as the trackball. • Ideally you should use a clean cloth and alcohol to cleanse the same. • Similarly in case of an optical mouse, you will need to clean the screen of the light-emitting diodes thoroughly so that dirt particles do not obstruct the light path the detects the movement of the surface below, which in turn causes the cursor movements on the screen. • Also, an optical mouse may not work quite well if the surface below is shiny or transparent.
Low Batteries	<ul style="list-style-type: none"> • In case of a wireless mouse, the problem may be due to the batteries, interference or range. • Instead of concluding that is a major problem and opting for a mouse repair, the for most thing you need to do is to check if the batteries are low and charge or replace them as required. • Interference may occur between the mouse and its receiver due to an object in the path of the signal or due to signals from other device. You will have to make sure that no such interference exists. • Be sure to place the pointing device, i.e. mouse within the specified range of its receiver.

Virus and Configuration Problem	<ul style="list-style-type: none"> • Virus can also be one of the reasons for the mouse working abnormally i.e. if the cursor jumps across the screen uncontrollably, clicking on its own, etc. • There are few viruses that may corrupt the mouse driver files and cause the mouse to malfunction. • Mouse troubleshooting in this context will involve scanning the PC with a good antivirus in order to get rid of the virus.
Problems with the Port or Mouse Driver	<ul style="list-style-type: none"> • To verify whether the trouble is with the mouse or PC, connect the mouse to a different PC to check. • If it functions perfectly on another PC, then there is probably some problem with the port where it was connected or with the mouse driver in the system. • Check by connecting the mouse to another port.
Bluetooth Mouse Not Responding	<ul style="list-style-type: none"> • Make sure that the polarity of the batteries is correct. The positive (+) and negative (-) ends of each battery must match the positive (+) and negative (-) connections in the battery housing. • Make sure the batteries are changed. • Verify that the computer is Bluetooth enabled. • Verify that the device drivers are installed.

6. Explain in detail Hard Disk Drive Troubleshooting

Problem	Causes	Solution
Hard disk will not auto detect in the CMOS setup program	<ol style="list-style-type: none"> 1. Verify Hard disk drive get enough power and disk is spinning. If it does not spin, then drive has problem or power problem. 2. Make sure the power input connection to the disk is tight. 3. Check other peripheral power, if they don't get enough power then power supply have problem. 4. Verify jumper setting is correct on Hard disk drive. 5. Make sure that IDE controller is enabled. See in CMOS setting. 6. Try hard disk in other system; if problem will not solve then hard disk have problem, otherwise problem in system. 	

	<p>Or try other with Hard disk if problems not solve then system have some problem otherwise previous Hard disk have problem.</p> <p>7. Try with other IDE cable if it is work the IDE cable have problem.</p>	
Computer is running slowly or operating programs on the hard disk has become slow.	<ul style="list-style-type: none"> The volumes on your hard disk may have become excessively fragmented, possibly because you have recently created a large number of files or folders or have installed new software. 	<ul style="list-style-type: none"> Analyzed and then defragment the volumes on your hard disk if necessary. For more information.
Hard disk drive is not detected	<ul style="list-style-type: none"> Miss alignment of power/interface cable Wrong setting of Master/Slave Jumper 	<ul style="list-style-type: none"> Verify the Hard disk drive power/interface cable Verify the Master /Slave Jumper setting.
The Hard disk drive is not bootable nor accessible at all	<ul style="list-style-type: none"> Wrong Configuration Hard disk is dead 	<ul style="list-style-type: none"> Detect you Hard disk CMOS setup, if it can detect then there is operating system is crash, install operating system. If Hard disk is not detected in CMOS setup, verify the cable connection on motherboard, power cable and data cable Verify the Master/Slave Jumper setting.
The Hard disk drive generate more noise	<ul style="list-style-type: none"> Verify the hard disk drive is the source of the noise by removing the cover of the system and identifying the hard disk drive as the source of the noise. Run diagnostics on the hard disk drive. Replace drive if diagnostic testing reveals a failure. Back up your important data. It may be dead soon! 	

<p>“No ROM basic system halted” error message during startup (there are no active partitions)</p>	<ul style="list-style-type: none"> • Drive that drive is install properly. • There is no active partition 	<ul style="list-style-type: none"> • Verify that drive is install properly • Set active partition using FDISK or other utility program.
<p>Hard disk does not boot well even after formatting.</p>	<ul style="list-style-type: none"> • Is the Boot Sector Virus Protect (Virus Warning for AMI BIOS, AWARD), set to Enable in CMOS set-up? This is read only setting of the Boot Sector to protect the hard disk drive data from virus. Change the setting to Disable and return the FDISK and FORMAT Program. • Run the FDISK program and check to see if the hard disk drive status is set to A(Active). If it is not set to A, it doesn’t boot so from the Set Active partition, the second selection of the FDISK, select C:/, Reset, and then reboot the system. 	
<p>Message display on screen “error while reading drive c:”</p>	<ul style="list-style-type: none"> • Virus problem • Wrong Configuration • Other drive contain media 	<ul style="list-style-type: none"> • Check the Hard disk drive cables, connector and jumper setting • Scan with best antivirus • If hard disk drive is not first priority in CMOS setting, verify CD Drive or floppy Drive not Contain any disk.
<p>Hard disk becomes very slow</p>	<ul style="list-style-type: none"> • Software are not installed properly • Hard disk is infected by virus or worm. 	<ul style="list-style-type: none"> • Check the hard disk drive using the latest anti-virus definitions. • Clear temporary files from your hard disk drive. • If hard disk drive performance is still an issue, then reload the operating system.

7. Explain in detail Printer Troubleshooting

Problem?	Possible Solution
Printer does not anything on paper, even though cartridge is new.	<ul style="list-style-type: none"> Check the ink-level percentages on the printer screen. Replace any empty ink cartridges. You might have begun printing and then cancelled the process. If you cancelled the process printing started, the might have already loaded paper in preparation for printing. The next time you print, the printer ejects the blank page before starting the new printing project. Make sure the power module plug is firmly inserted in the printer's power socket and the other end of the cord is plugged into an outlet. Make sure any attached power strip is turned on and plugged into and outlet. If possible try using a different power outlet.
The printer is plugged in but will not turn on	<ul style="list-style-type: none"> The printer might have drawn too much power cord. Wait about 30 seconds, and then plug the cord back in. Turn on the printer. The printer might be plugged into a power strip that is turned off. Turn on the power. The power cord could be defective.
Margins are printed wrong	<ul style="list-style-type: none"> Check your margin setting in the software program. Make sure the paper is loaded in the correct orientation.
Printer printing single character on each page	<ul style="list-style-type: none"> The computer to printer connection failed or the printer failed. Turn off the printer, disconnect the printer cable from the back of the printer, and turn the printer on again. Cancel all print jobs at the computer, reconnected the printer cable, and resend the file to the printer. If the printout is still garbled, the problem may be with the printer cable, the cable connections, the computer port, or the selected printed drive.
Color printer produce black and white output instead of color	<ul style="list-style-type: none"> Color printing is not selected in your printer software. The color setting are inappropriate; adjust them in the software provide by manufacturer.
Printing is very slow	<p>➤ Cause :</p> <ul style="list-style-type: none"> You might be high-resolution graphics or photos. Large, complex projects containing graphics or photos print slower than text document. <p>➤ Solution:</p> <ul style="list-style-type: none"> Consider using lower resolution graphics in the project, if possible, or allow for longer print times in your workflow.

Paper does not feed into the printer correctly from the main tray	<ul style="list-style-type: none"> • Reduce the number of sheets in the main tray • Push the main tray into the printer until it is seated correctly. • Check that the paper is not stacked above the height of the paper-length guide. If it is, remove some paper and try printing again. • Two or more pieces of paper might be sticking together. Remove the paper from the main tray, fan the edges of the stack to separate the sheets of paper, and then reload the paper and try printing again. • If the paper is wrinkled or bent, try using different paper. • The paper might be too thin or too thick.
The document printed at an angle or off-center	<ul style="list-style-type: none"> • The paper might not be loaded correctly. Reload the paper, making sure it is correctly oriented in the tray and that the paper-width and paper-length guides fit close to the edges of the paper.
Colors are not printing satisfactorily	<ul style="list-style-type: none"> • A cartridge is out of ink. Replace it. • Some of the ink nozzles on the print heads are clogged. Clean the print head. • The color management setting of the printer software matches the type of media loaded in the tray.
The paper jammed while printing or no page came out of the printer	<ul style="list-style-type: none"> • If the paper jammed while printing, try the following : <ul style="list-style-type: none"> ○ Turn off the printer, and then unplug it from the power source. Remove the rear door. Gently remove the jammed paper from the printer, and then replace the rear door. Open the top door and clear the printer of any paper obstruction the paper path. If needed, gently move the print head assembly to one side to remove the paper. Plug the printer back in and turn it on. Try printing again. ○ If you were printing labels, make sure a label did not become unglued from the label sheet while going through the printer. • Try pulling out main tray and replacing it in the printed, making sure to push the tray in as far as it will go, until it is fully seated. • The printer might need attention. Read the printer screen for instructions.
The printer ejects the paper when preparing to print	<ul style="list-style-type: none"> • Direct sunlight could be interfering with the operation of the automatic paper sensor. Move the printer out of direct sunlight.

Print quality is poor	<ul style="list-style-type: none"> • You might be printing on the wrong side of the paper. Make sure the paper is loaded in the main tray with the side to be printed facing down or in the specialty media tray with the side to be printed facing up. • The connection between a print cartridge and the cradle is intermittent. Remove the print cartridge and reinstall it. • You may run out of ink. Replace the cartridge. • There might be a problem with a print head. Try the following: <ul style="list-style-type: none"> ○ Run an automatic cleaning procedure from the printer control panel. ○ Calibrate the printer from the control panel. ○ Clean the nozzles on the print heads.
Error message on screen: Out of paper. Load paper then press OK.	<ul style="list-style-type: none"> • Load paper, and then press OK to print again.
Error message on screen: Automatic paper sensor failed.	<ul style="list-style-type: none"> • The automatic paper sensor is obstructed or damaged.

Specific Printer Type Troubleshooting

1) Dot /matrix Troubleshooting

- Smudges can be caused by the ribbon tension being too high.
- Broken printer head pins can causes incomplete or missing characters.
- If the tops of characters are missing, the printer head is misaligned with the platen and needs to be reseated or the printer head carriage may need to be adjusted.
- If the print gets lighter on the page from left to right, the printer head distance from the plate is uneven and will need to be adjusted.

2) Ink Jet Printer Troubleshooting

- Never refill cartridge which are causing problems. The head is part of the cartridge so replace the entire cartridge.
- If the output is disfigured wavy, make sure the paper thickness level is in the correct position. If it is, then paper feed rollers probably need to be replaced.

3) Laser Printers Troubleshooting

- Blank Pages-Can be caused by No Toner, Transfer Corner Failure or HVPS Failure.
- Speckled Pages- Due to a failure in the cleaning step of the EP Process. Or scratches on the EP drum.
- Ghosted Images – Caused if the erasure lamp doesn't erase the entire image from the EP

drum before the next page is printed.

- Smudged Image – The fusing process must have failed. The heating elements in the fusing rollers may be faulty.
- Dark spot – Can indicated toner build up at some point in the path. Running blank sheets through it may clear problem.
- Jams in laser printers usually occur in the paper pickup area, the fuser or the registration area. They can be caused by incorrect paper setting or media types.

8. Explain in detail Video Cards Troubleshooting

Problem	Causes	Solution
Nothing be display on monitor, unplug monitor from system will display the monitor self-test screen.	<ul style="list-style-type: none"> • Video card is corrupted. • Video card have loose connection on motherboard. • Primary RAM is damage. • Either motherboard have problem. 	<ul style="list-style-type: none"> • Check the video card connection on motherboard. • If video card is corrupted replace with new one. • Replace the primary RAM • Go to motherboard troubleshooting
The images on screen to flicker	<ul style="list-style-type: none"> • Low refresh rate. 	<ul style="list-style-type: none"> • Raise the refresh rate of the video card such that it cannot be extend the maximum allowable refresh rate for your monitor at your chosen resolution setting.
When setting high resolution, after sometimes system can hang.	<ul style="list-style-type: none"> • This is due to video card not having enough memory. 	<ul style="list-style-type: none"> • Upgraded to video card, which have higher memory supportable capabilities.
The Video image is intermittently fluctuating or disappearing either completely or practically.	<ul style="list-style-type: none"> • Video card loose connection on motherboard • Due to connector pin is bent, all pins do not have contact properly 	<ul style="list-style-type: none"> • Check for video card connection on motherboard • Check all connector all pins at the video card end monitor end have good contact.
Even through adding more video memory to the video card performance has not improve	<ul style="list-style-type: none"> • Additional video memory allows only display at higher resolution image or higher color depth but does not improve performance of the video card. 	<ul style="list-style-type: none"> • Increase the system RAM. • Replace good quality better video card.

9. Explain in detail Monitor Troubleshooting

No.	Problem	Causes	Possible Solution
1.	Picture become fuzzy on monitor Screen	Monitor controls	<ol style="list-style-type: none"> 1. Adjust the monitor display controls (H-position, V-position etc.) 2. Adjust the brightness control
2	Nothing will display on monitor	<ol style="list-style-type: none"> 1. Power switch 2. Video card 3. Signal cable 4. Check power LED 5. Lowest contrast or brightness 	<ol style="list-style-type: none"> 1. Comp. Power switch should be in on position 2. Video and should be fit in its slot 3. Signal cable connected to the computers 4. Check the color of the power LED indicates if its orange, than the monitor and PC system in power saving mode, you need press your keyboard or move mouse to reactivate the system 5. Adjust the brightness and contrast of monitor
3.	Only one horizontal raster line is appears	<ol style="list-style-type: none"> 1. Deflection yoke vertical will shorted or open 2. Fault in vertical circuit 	<ol style="list-style-type: none"> 1. Check it and replace 2. Check vertical circuit's 3. Discrete component 4. Replace vertical circuit IC
4.	Only one vertical raster line is present	Deflection yoke horizontal will bad	Check it for short or open in deflection yoke horizontal coils
5.	Raster (Display) appears after long delay	CRT deterioration	Changing picture tube.
6.	Display suddenly vanishes and appears	<ol style="list-style-type: none"> 1. Poor soldering in video circuit 2. Loose contact in CRT socket 	<ol style="list-style-type: none"> 1. Inspect soldering in circuit if its poor then solder it 2. Check the CRT socket
7.	Raster Present but no video	<ol style="list-style-type: none"> 3. Video cable conduct problem 4. VSYNC & HSYNC not received at IC 	<ol style="list-style-type: none"> 3. Check and insert video cable properly 4. Check the relevant

			components
8.	Display is not stable is light shaking	5. Power supply has excess ripples 6. Electromagnetic interference	5. Check whether ripple is < 10 mv peak to peak 6. Identity any source near the monitor causing alternating magnetic field.
9.	Displays roll in vertical direction	Miss-adjustment of vertical hold control	Adjust the vertical hold control present
10.	Displays roll in the horizontal deflection	Miss –adjustment of horizontal hold control	Adjust the horizontal hold control present
11.	Display fix color on corner of monitor	1. Some device having magnetic field is very near to your monitor such as speaker 2. Your picture tube will damage	1. Away this device from the monitor 2. Replace the picture tube
12.	Colors on screen shifted toward a specific color	1. One of the color signals is not getting through to the screen 2. Monitor cable	1. Examine the cable connectors for bent pins 2. Replace monitor cable
13.	No raster and LED not glowing	1. Fuse blown 2. Power supply bad	1. Check and replace fuse 2. Check power supply circuit.
14.	No raster and LED glowing	1. Brightness control in extreme OFF 2. Loose connections in power circuit.	1. Turn brightness control fully ON and confirm. 2. Check all cable connection.
15.	Poor contrast	Video under driven	Adjust the video drive present
16.	Vertical black bar	Unstable voltage at control grid	Check the voltage and the relevant capacitor.
17.	Display height abnormal	Miss adjustment of vertical height	Adjust corner present
18.	Raster appears after long delay	Deterioration	Change picture tube
19.	Fine noise on the screen	1. Contrast problem in connectors 2. Leakage in high voltage portion	1. Check connectors 2. Check high voltage

			portion
20.	Small raster size and abnormal brightness of picture	Abnormal high voltage	Check for high voltage
21.	Spot seen when power OFF	Ageing of CRT	Replace picture tube
22.	Defocusing of dots	Focus voltage improper	Adjust the focus present
23.	Inclined display	Miss adjustment of deflection yoke	Adjust the deflection yoke by turning

10. Explain in detail Preventive Maintenance Tools

- There are several pieces of hardware that can be very helpful in troubleshooting some specific hardware problems. Some are more expansive and are used for specific types of problems, making them less universally applicable than the general software utilities that are widely encountered.
- There are two types of troubleshooting tools: Hardware Tools and Software Tools. The following sections describe detail about these tools.

Hardware Tools

The following are most common hardware tools used for PCs maintenance.

- 1) Multimeter/Ohmmeter
- 2) Oscilloscope
- 3) Logic Analyzer
- 4) Logic Probe
- 5) Logic Pulser
- 6) Current Tracer

1) Multimeter/Ohmmeter

- A Multimeter can be used for measurement of resistance, voltage, current and also test the continuity of cable. These devices are used by electricians and electronics designers. It has low cost and simple in working. A simple ohmmeter is useful for checking for short circuit or open circuit, while multimeter can be used for extensive electronics.

2) Oscilloscope

The Oscilloscope helps to resolve almost any problem in a PC. It is useful in three levels of testing.

1. To test logic levels.
2. To measure the various signal characteristics such as pulse width, frequency, rise and fall time, noise etc.
3. To measure relationship between two or more signals.

3) Logic Analyzer

- The logic analyzer is a multichannel Oscilloscope with a memory.
- It can capture and store a number of digital signals, for viewing the signals simultaneously.
- Using logic analyzer it is possible to see the entire data bus at one time. This can analyze the logic level for each bit on the bus for any time.
- A logic analyzer may be triggered on a complicated sequence of digital events, and then capture a large amount of digital data from the system under test.
- It can have ability to freeze a signal data pattern any time, which gives advantage of troubleshooting.
- Logic analyzers can uncover hardware defect that are not found in simulation.

4) Logic Probe

- Logic probe is low cost, compare to Oscilloscope, hand held test equipment.
- It is used to find out logic state of any node in a circuit.
- The internal circuit in a logic probe is powerful to detect even very narrow pulses.
- Using logic probe nearly 85% of the faults can be diagnosed without an Oscilloscope.
- There are usually three differently-colored LEDs on the probe's body:
 - Red and green LEDs indicate high and low states respectively.
 - An amber LED indicates a pulse
- The pulse-detecting electronics usually has a pulse-stretcher circuit so that even very short pulses become visible on the amber LED.
- A control on the logic probe allows either the capture or storage of a single event or continuous running.
- When the logic probe is either connected to an invalid logic level (a default condition or a tri-stated output) or not connected at all, none of the LEDs lights up.

5) Logic Pulser

- The logic Pulser is a hand held tool used to inject pulses at the input of a gate under test.
- A single pulse or a stream of pulses at different frequencies is issued as per the user's choice.

6) Current Tracer

- The current tracer is a hand held tool which detects current flow in electronic circuit.
- It is useful in locating shorted components, track shorts, solder bridge, V_{cc} to ground shorts, etc.

Software Tools

A) Diagnostic Software

- Even though the POST is reasonably powerful, it cannot catch all types of problems in hardware. To verify if the hardware is totally fault free, we need more powerful diagnostic

programs which can run exhaustive test on the hardware modules and report the detected faults with sufficient details.

- The diagnostic software is externally useful under the following situation:
 - There is an intermittent hardware fault in the PC.
 - When not decided easy whether problem is in hardware or in software.
 - The POST fails to detect problem.
- The following section is provides information about various diagnosis software available in most of by Microsoft Windows operating system.

1) MEM.EXE

- This is simplest utility for display information about allocated memory areas, free memory areas, and programs that are currently loaded into memory in the MS-DOS
- Subsystem. Used without parameters, MEM displays the status of the MS-DOS subsystem's used and free memory. Using following parameter with MEM gives the specific information.

/Program

Display the status of programs that are currently loaded into memory.

/debug

Display the status of currently loaded programs and internal drivers, and other programming information.

/classify

Display the status of programs loaded into conventional memory and the upper memory area (UMA).

/?

Display help at the command prompt.

2) Dr. Watson:

- Dr. Watson detects information about system and program failure and records the information in a log file. In the event of a program error. Dr. Watson starts automatically. Dr. Watson is the information needed by technical engineer to diagnose a program error for a computer running windows. A text file (Drwstn32.log) is created whenever an error is detected, and can be delivered to support personnel by the method they prefer.
- Dr. Watson cannot prevent error from occurring, but the information record in the log file can be used by technical support personnel to diagnose the problem.

3) Device Manager

- Device manager provides you with information about how the hardware on your computer is installed and configured, and how the hardware interacts with your computer's programs. Devices Manager provides you with a graphical view of the hardware that is installed on your computer. You can use Device Manager to update the drivers for hardware devices, modify hardware settings, and troubleshoot problems. You will typically use Device Manager to check the status of your hardware and update devices drivers on your computer. Hardware engineer might use Device Manager's diagnostic features to

resolve device conflicts and change resource settings.

4) Norton Diagnostics (norton Utilities)

- Norton utility includes tests of the processor, motherboard, and system memory and will identify some type of resource conflicts. It performs tests on the hardware to identify problems beyond the system information program. The some of key features of Norton utility suit are listed below:
 - Space Wizard, which frees up storage space by removing unnecessary and duplicate files.
 - System information used for providing detailed system analysis.
 - Disk doctor used for diagnoses and repair disk drives.
 - System Doctor, which runs in the background and lunches the needed utilities to solve a problem when detected.
 - Rescue Disk Set used for restart and repair your system even when operating system will not load. These diskettes include DOS version of Norton Utilities so you restart your system in DOS, analyze the problem and fix it.

B) Disk Utility Software

1) Disk Clean-up

- As part of standard maintenance, Disk Cleanup scheduled to run at regular intervals. Perhaps once a month, at some convenient time when your computer is not otherwise in use. Here's how to run Disk Cleanup: Click Start, -Programs, -Accessories, point to system Tools, and then click Disk Cleanup. This will take a while.

2) Disk Defragmenter

- Defragmenting your hard drive is an integral part of keeping your PC healthy, the defrag utility which ships with windows is very simple to use and can give a boost to your PC's performance. The following section will show how to defragment your hard drive in windows.

What is Defragmenting?

➤ Fragmentation

- Fragmentation is caused when an operating system breaks a file into pieces because there is not enough space on the storage device where the file was originally saved one example of this would be where a file was originally saved, then modified causing the file to be larger in physical space than first anticipated, the operating system will then break the file into two or more pieces and store them in different parts of the storage area.
- The system would then keep a record of where the different parts of the file are stored; this is achieved through the use of a File Allocation Table (FAT) or similar file system such as NTFS. Then, when the operating system requires the file again. It will query the file system (FAT/NTFS/or other) to find out where the different parts of the file are located on the partition (drive).

➤ **Defragmentation**

- Defragmentation is the term given to the process of scanning the file system and re-joining the split files back into consecutive pieces. The process of defragmentation can be time consuming, but it is one of the easiest ways to increase the performance of your computer system, the frequency of which a computer should be defragmented will directly depend on the amount of usage.

3) Scan Disk

- With Scandisk you can check the integrity of your disks (hard disks and floppy disks), and repair most problems that may occur. Windows 98 will start Scandisk automatically when the operating system is shut down improperly or disk contains a critical error. This is not enough! Running Scandisk through Windows allows you to specify several options and run a more thorough scan of your hard drive. When you use Scandisk the following configuration settings are available:
 - **Standard:**
 - Use this option to check files and folders for errors
 - **Thorough:**
 - Use this option to perform the standard test and also scan your disk for physical errors. This may take a long time to check your disk depending on the size of your disk.

☞ **What Scandisk checks and fixes?**

➤ **Cross-Linked Files:**

- A cross-link occurs when two or more files use the same cluster (area of a disk) at the same time. You can choose to delete these, make copies or ignore them (Personally I usually delete)

➤ **Lost File Fragments:**

- File fragments are parts of files on your disk that were lost by a program. You can choose to free the file fragments to recover the disk space or convert them to new. When you save file fragments to your disk, the file fragments are converted to file names such as file0000.chk and are stored in the root folder of your disk. You can use any text editor (such as Notepad) to view the saved file. This file may or may not contain any useful information. I have never seen one contain useful information but maybe that is just me.

➤ **Verify file names, dates, times:**

- Don't ask me how this information is lost or misguided, but occasionally this information is lost and you will have difficulty accessing these files. Always fix.

➤ **Physical errors:**

- A thorough scan allows you to perform a surface Test, to look for physical problems with the hard drive. Scandisk can't exactly fix physical problems but it can recognize that there are

problems and then let the operating system know that it should NEVER write data to that area again. These physical problems are known as “Bad Blocks.”

To start Scandisk, use the following steps:

1. Click Start, point to programs, point to Accessories, point to system Tools, and then click Scandisk.
2. Select the options and features you want to use, and then click Start.

11. What are the Layman Checks for computer maintenance?

- Without systematic approach, some problems can be quickly resolved by adopting few shortcuts. These are known as layman checks. The layman check can be applied even by not technical person. The following list provides some important layman checks.
 1. Is the Main AC power is on?
 2. Does the SMPS switch is on?
 3. Is SMPS fan work?
 4. Is SMPS connector properly connected on motherboard?
 5. Is AC power plug connected?
 6. Is CMOS setup parameters correct?
 7. Is monitor contrast control in maximum?
 8. Is monitor brightness control in maximum?
 9. Is monitor power switch on?
 10. Is monitor cable to Display adapter connected?
 11. Is monitor getting enough power?
 12. Is the Hard disk drive connected?
 13. Is Hard disk drive cable connected?
 14. Is the device switch setting in the Hard disk drive match the requirement?
 15. Does the LED on floppy drive A glow?
 16. Is the keyboard connected?
 17. Is the keyboard switch in the right position?
 18. Are there speaker beeps?
 19. Is the speaker click heard?
 20. Is the printer power on?
 21. Is the printer cable connected?
 22. Are papers in printer's tray before printing?