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S.Y. Diploma : Sem. IV [CO/CD/CM/CW/IF]
Computer Hardware & Maintenance
Prelim Question Paper Solution

1. (a) (i) Features of PCI bus

- 1) extremely high speed data transfer.
- 2) parity on both address and data line.
- 3) full multi master capability.
- 4) processor independence.
- 5) new approach.
- 6) forward and backward compatibility.

1. (a) (ii) Form Factor

Form factor determines the general layout, size and feature placement on a motherboard. Two form factors of motherboard are :

- 1) AT
- 2) Baby AT
- 3) ATX Mini-ATX
- 4) Micro-ATX Flex ATX
- 5) LPX Mini LPX
- 6) NLX

1. (a) (iii) Advantages of CRT over LCD

- 1) Significantly lower cost compared to LCD, because of advance technology.
- 2) Color fidelity is essential for graphic artists.
- 3) Contrast ratio allows perception of true black. Darks are darker.
- 4) It has the ability to adjust multisync images.
- 5) It has very good multiple resolutions.
- 6) Displays full motion video better.
- 7) Sleep-mode for energy efficiency is included in modern versions.
- 8) Flat viewing screens for fewer glares are available.

1. (a) (iv) RFI (Radio Frequency Interference) Protection

It occurs at frequencies > 10 KHz. It can destroy the data in magnetic disk. It can disturb the electron beam in the CRT monitor, causing improper deflection. To avoid RFI effect on PC operation 1. Locate computer system at least 6 ft. away from TV set. 2. Reposition the TV antenna if interference occurs. Subscribe the cable TV to avoid antenna connection.

Electrostatic Discharge

Whenever the user walks over woolen carpet, the body develops static voltage / charge. If PC is touched for servicing, this static charge, discharges through the PC components to PC-Chassis – gnd. This heavy discharge current may damage the PC components. Causes :

- 1) *Lightening* : To avoid this, lightning arresters are used.
- 2) *Carpets in Computer Room* : Earth belts must be used to discharge static charge before operating PC.

1. (a) (v) Advantages of Laser Printer

- Laser printers are far cheaper to operate. It is a well-known fact that vendors give inkjet printers away knowing that they will make lots of money on the ink. Laser printers may cost more up front, but the cost per page is a little as a tenth of what it is for inkjet printers.
- Laser printers offer waterproof printing. Ever had the ink smear when it got wet? Doesn't happen with a laser printer - plastic is melted to the sheet and is completely water-proof.
- Print quality is better. You can "feel" and see the difference. Laser printers are the standard for professionally printed letters. Ever notice how nice that letter is that you got from your doctor or lawyer's office? It was printed on a laser printer. You can really feel the difference.

1. (a) (vi) Line regulation : It is the ability of the power supply to maintain a constant output power even though there is change in the input supply.

Load regulation : It is the ability of the power supply to maintain a constant output power even though there is change in the load at output.

1. (a) (vii) Partitioning is a procedure which divide the hard disk into multiple sections or logical parts. Each partition is comprised of several cylinders or tracks. Different operating systems may be stored on different partitions. FDISK.exe program is used for creating partitions on a disk. It is a utility provided by DOS.

1. (a) (viii) USB Features

- 1) *Host* : The computer acts as a Host.
- 2) *Multiple devices* : We can connect up to 127 devices to the host directly or by USB hubs.
- 3) *USB Cable length* : Individual USB cables can be as long as 5 meters; with hubs, devices can be upto 30 meters away from the host.
- 4) *Transfer Rate* : The initial USB 1.0 standard supported 12 Mbps transfer rate. The USB 2.0, the bus has a maximum data rate of 480 megabits per second.
- 5) *Ease of installation* : A USB cable has two wires for power (+5 volts and ground) and a twisted pair of wires to carry the data.
- 6) *Hot-swappable* : USB devices are hot swappable, meaning you can plug them into the bus and unplug them any time.
- 7) *Power Saving* : Many USB devices can be put to sleep by the host computer when the computer enters a power saving mode.
- 8) *Power allocation* : USB controller in PC detects the presence or absence of the USB devices and does allocation of electrical power. On the power wires, the computer can supply upto 500 milliamps of power at 5 volts. Low power devices (such as mice) can draw their power directly from the bus. High power devices (such as printers) have their own power supplies and draw a minimal power from the bus. Hubs can have their own power supplies to provide power to devices connected to the hub.

1. (b) (i) Comparison between Interlaced and Non-Interlaced Scanning

	Interlaced	Non-interlaced
1)	2 passes needed	Single pass needed
2)	No flickering	Flickering is there
3)	Image quality is good	Image quality is not good
4)	Stable image	Not stable image
5)	Cost is more	Cost is less

1. (b) (ii) Comparison between Inkjet and Dot Matrix Printer

	Parameter	Dot Matrix	Inkjet
1)	Type	Impact	Non-Impact
2)	Speed	Depends on quality of printing, maximum upto 533 characters/sec per line.	Upto 30 pages per minute.
3)	Cost	Inexpensive	Expensive
4)	Noise	Noisy	Quiet
5)	Printing	Can print multiple copies simultaneously	Cannot print multiple copies simultaneously
6)	Technology	Ribbon Cartridge	Liquid Ink

1. (b) (iii) Characteristics of CRT Monitors

- 1) Resolution describes the number of potential pixels the monitor is capable of displaying.
Resolution = Total Horizontal Pixels × Total vertical pixels
- 2) *Frame rate* : It is the number of Frames per Second. Higher the frame rate, less the flicker problem.
- 3) *Video Bandwidth* : It is the highest input frequency a monitor can handle and helps in determining the resolution capabilities of the monitor .The video bandwidth is measured in MHz. Higher the video bandwidth, better the image quality.
Bandwidth = Hor. Pixel × Ver. Pixel × Frame rate
- 4) *Scanning frequency* : Horizontal and vertical
 - *Horizontal* : The frequency at which the horizontal lines form an image is called Horizontal Scanning Frequency(KHz)
 - *Vertical* : It is the frequency at which screen gets refreshed is the Vertical scanning frequency(Hz).
- 5) *Dot pitch* : It is the measurement of the distance between dots on a CRT. It is independent of the size of the tube or the displayed image.
- 6) *Pixel* : An individual dot on the screen. Each pixel can be of different color thus producing the images.

2. (a) Real Mode (8086 mode)

Original IBM PC could address only 1 MB of RAM as it had only 20 address lines. It could execute 16 bit instructions using 16 bit internal registers. Example : DOS operating system. When a processor is running in real mode it has the advantage of speed but it accesses memory with some restrictions.

Later processors like 286 could run the same 16 bit instructions but much faster. The 16 bit instruction mode of 8088 and 286 processors is known as real mode. All softwares running in real mode must use only 16 bit instructions and live within the 20 bit (1 MB) architecture it supports. Software of this type is usually single tasking – only one program can run at a time. No built in protection exists to keep one program from overwriting another program or even the operating system in the memory.

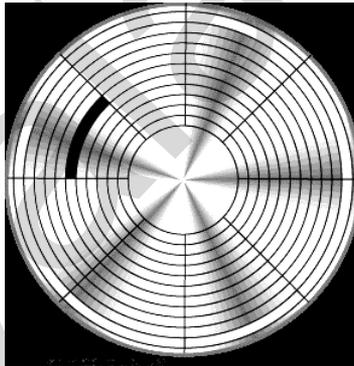
2. (b) Terms related to Hard Disk

- **Cluster**

- When OS writes some information on the hard disk, it does not allocate the space sector wise, instead uses a new unit of storage called “Cluster”.
- Clusters are the minimum space allocated by DOS when storing any information on the disk.
- Even to store only one byte long information on the disk requires minimum one cluster area on the disk surface.

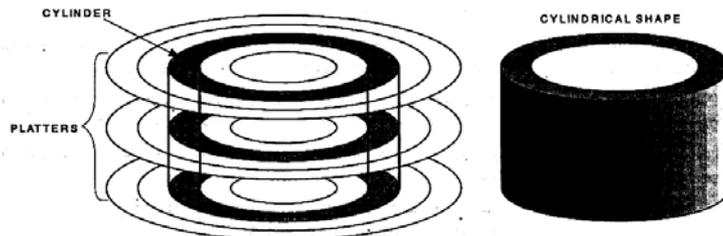
- **Sector**

- The formatting program divides disk surface into sectors by writing magnetic pattern on disk surface.
- Different HDD capacities have different number of tracks.
- 512 byte data can be stored in each sector. Sector no. starts from 1.



- **Cylinder**

- Same tracks of different platters form an imaginary cylinder like structure.
- Data is stored cylinder by cylinder.
- All tracks on a cylinder are written and then the R/W head moves to the next Cylinder. This reduces movement of R/W head and increases the speed of read and write operation.

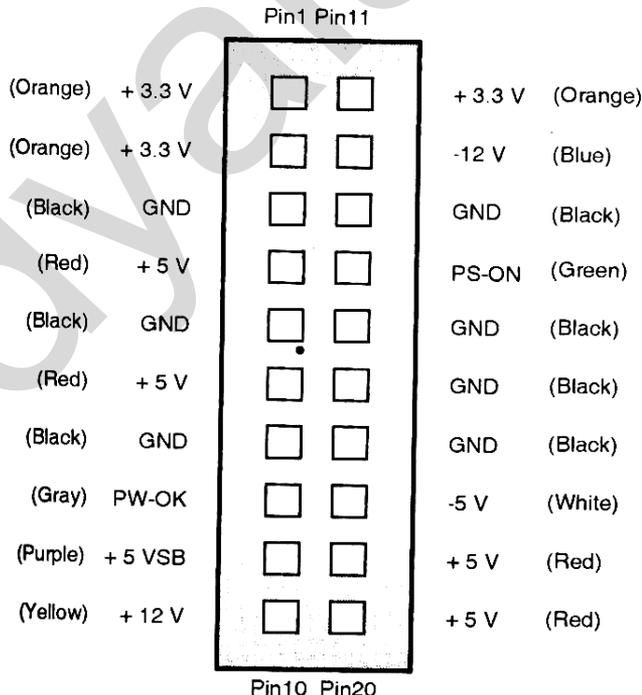


- **Track**
 - Each side of HDD platter's surface is divided into concentric circles called tracks.
 - They are magnetic information written during formatting of HDD.
 - Outermost track is called track 0. The innermost will have the highest number.

2. (c) Functions of North and South Bridge

- **North Bridge** : It is the connection between the high speed processor bus and the slower AGP & PCI buses. It is responsible for communication from the CPU to memory, the CPU to the PCI (Peripheral Component Interconnect) Express bus, and the Advanced Graphics Port (AGP) device. It is the only motherboard circuit (besides the processor) that runs at the full motherboard speed. It serves as the four way connection between CPU, Memory, Video card and south bridge.
- **South Bridge** : It is the bridge between PCI bus and even slower ISA bus. It is responsible for communication between the CPU and other devices, such as PCI, ISA, and IDE devices. The Southbridge actually contains some on Chip integrated peripherals, such as Ethernet, USB and audio devices. It is responsible for communication between the CPU and other devices, such as PCI, ISA, and IDE devices. These two chips contain the bulk of the logic that allows a CPU to communicate with other hardware.

2. (d) 20 pin ATX Power Connector



Raw 20 pin ATX power connector with color code.

State function of PS-ON, 5VSB, PWR_OK Signals.

- THE PS-ON is an input to SMPE only when this signal is low; the SMPS outputs should be ON. Otherwise the output should be OFF. This signal can be generated by software.
- The 5VSB is a standby voltage, which supplies power to special circuits even when the SMPS and the system are off.
- The PWR_OK is a power good signal.

2. (e) BIOS

The BIOS (Basic Input Output System) provides the processor with the information required to boot the system from a non-volatile storage unit (HDD, FDD, CD or other). It provides the system with the settings and resources that are available on the system.

BIOS is an electronic set of instructions that a computer uses to successfully start operating. The BIOS is located on a chip inside of the computer and is designed in a way that protects it from disk failure. Main functions of BIOS :

- 1) The main function of the BIOS is to give instructions for the power-on-self-test (POST). This self-test ensures that the computer has all of the necessary parts and functionality needed to successfully start itself, such as use of memory, a keyboard and other parts.
- 2) If errors are detected during the test, the BIOS instruct the computer to give a code that reveals the problem. Error codes are typically a series of beeps heard shortly after startup.
- 3) The BIOS also works to give the computer basic information about how to interact with some critical components such as drives and memory that it will need to load the operating system.
- 4) Once the basic instructions have been loaded and the self-test has been passed, the computer can proceed with loading the operating system from one of the attached drives.
- 5) Computer users can often make certain adjustments to the BIOS through a configuration screen on the computer. The setup screen is typically accessed with a special key sequence during the first moments of the startup. This setup screen often allows users to change the order in which drives are accessed during startup and control the functionality of a number of critical devices. Features vary among individual BIOS versions.
- 6) Many PC manufacturers today use flash memory cards to hold BIOS information. This allows users to update the BIOS version on computers after a vendor releases an update. This system was designed to solve problems with the original BIOS or to add new functionality. Users can periodically check for updated BIOS versions, as some vendors release a dozen or more updates over the course of a product's lifetime. To check for updated BIOS, users can check the website of the specific hardware vendor.

2. (f) Advantages of Optical Mouse

- 1) Optical mouse does not accumulate dust on itself like the roller mouse. The roller mouse used to accumulate dust on the ball and on the edges making the device less efficient and slower.
- 2) Uses the sensor so better communication.

- 3) The roller mouse was also heavier and required a mouse pad for smooth rotation of the ball, whereas there is no particular necessity for a mouse pad in the optical mouse.

3. (a) Difference between Low Level and High Level Formatting

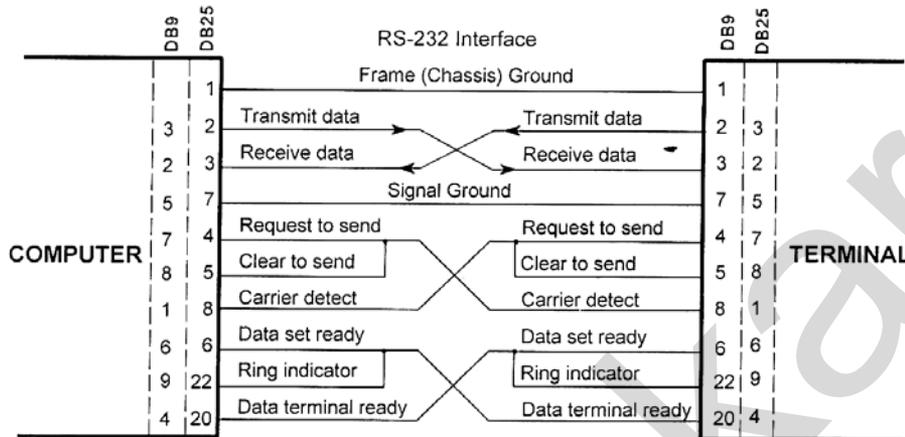
	High Level Formatting	Low Level Formatting
1)	It is done at users premises	Low level formatting done at manufacturers premises
2)	It is the process of creating the disk's logical structures such as the file allocation table and root directory.	It involves the creation of the actual structures on the surface of the media that are used to hold the data.
3)	The high level format uses the structures created by the low level format to prepare the disk to hold files using the chosen file system.	Recording the tracks and marking the start of each sector on each track. This is called as low level formatting and sometimes is called "true formatting".
4)	It is easy process so it does not require experts.	It is difficult process, so required experts.
5)	After high level formatting we can store data on disk.	After low level formatting disk is not able to store data.

3. (b) SCSI

SCSI drives are complicated when compared with IDE drives while configuring. The SCSI standard controls the way the drives must be set up. Following setup has to be done while configuring SCSI drive :

- i) *SCSI Device ID* : Every device on a SCSI bus must be uniquely identified for addressing purposes. Narrow SCSI drives will have a set of three jumpers that can be used to assign the disk an ID number from 0 to 7. Wide SCSI drives will have four jumpers to enable ID numbers from 0 to 15. Some systems don't use jumpers to configure SCSI device IDs.
- ii) *Termination activate* : The devices on the ends of the SCSI bus must terminate the bus for it to function properly. If the hard disk is at the end of the bus, setting this jumper will cause it to terminate the bus for proper operation.
- iii) *Disable auto start* : When present, this jumper will tell the drive not to automatically spin up when the power is applied but instead wait for a start command over the SCSI bus. This is usually done to prevent excessive startup load on the power supply. If by default startup is disable then it is provided by an "Enable Auto Start" jumper.
- iv) *Stagger spin* : An "enhanced version" of "Delay Auto Start". When a system with many hard drives has this option set for each unit, the drives stagger their startup time by multiplying user-defined constant times their SCSI device ID. This ensures no two drives on the same SCSI will start up simultaneously.
- v) *Narrow/Wide* : Some drives have a jumper to control whether they will function in narrow or wide mode.

3. (c) RS-232 Communication



RS 232 Signals

- *Carrier Detect* : This signal gives a modem a means of signaling the data terminal that it has made a connection with the distant modem.
- *Receive Data* : The bits coming in from a distant serial port go through receive data line.
- *Transmit Data* : The serial data leaving the port travels on Transmit data line.
- *Data Terminal Ready* : When the data terminal is able to participate in communications, it signals its readiness by applying a positive voltage on the DTR line.
- *Signal Ground* : It provides the return path to all the signals used in the serial port.
- *Data Set Ready* : When the data terminal is ready to receive data, it signals its readiness by applying a positive voltage on the DSR line.
- *Request To send* : When the data terminal is on and capable of receiving transmissions, it puts a positive voltage on the request to send line. Absence of RTS signal will prevent the data set from sending out the data.
- *Clear To Send* : The data set needs to control the signal flow of from the data terminal. The CTS signal indicates to the data set that data can be sent. Absence of CTS signal will prevent the data set from sending out the data.

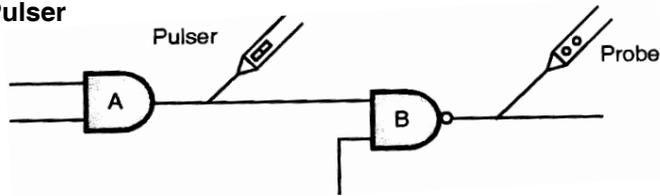
3. (d) Hardware tools used for trouble shooting of PC

- Logic Pulser
- Logic Analyzer

Software tools used for trouble shooting of PC

- Norton Utilities
- QAPlus

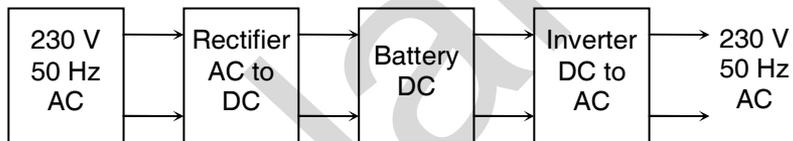
3. (e) Logic Pulser



- It is used to inject pulses into the circuit using logic pulser.
- A logic pulser is designated to test circuit reaction by delivering a logical high (+5 V) pulse into a circuit.
- Logic probe and pulser are used together to test ICs and verify truth table.
- It has ability to introduce a changing signal into circuit without desoldering or cutting wires.
- The above figure shows several way to test logic gates using the probe and pulser. Pulser injects pulses to output of AND gate and probe should checking or indicating a change at the input to the NAND gate.
- If probe does not blink, you know this line or gate is shorted to ground.

3. (f) On-line UPS

Block diagram of on-line UPS



It contains a transformer, a rectifier and a filter which convert AC into DC

- This DC is given to the battery charger which charges the battery. The output of the battery is given to the inverter which converts DC to AC and gives it to the PC.
- In this type of UPS the system is supplied power from the batteries continuously.
- Thus the battery charges continuously and it provides DC voltage to the inverter.
- The inverter converts DC to 230V, 50Hz AC signal and gives it to the computer.
- As switching is not involved, spikes are not generated.
- It isolates the AC mains from the PC.

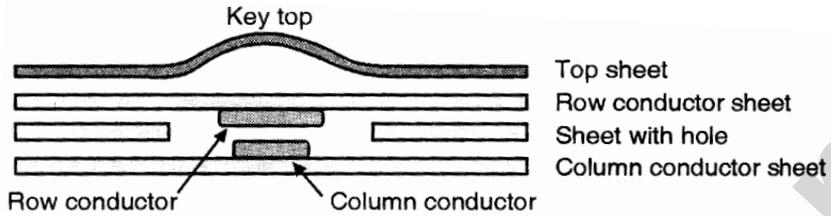
Advantages :

- 1) Since switching is not involved, it avoids resetting of PC and spike generation.
- 2) It isolates AC mains from the PC.

Disadvantages :

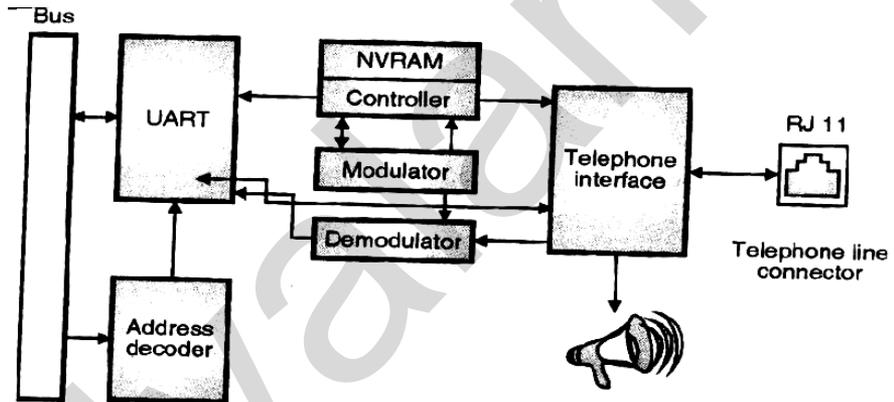
- 1) It is costlier than off-line UPS.
- 2) It generates more heat.

4. (a) Working of Membrane Switch



- (a) It is a multi-layer plastic or rubber assembly.
- (b) It is used as keyboard in video game machines, calculators, medical instruments, cash registers etc.
- (c) Two rubber or plastic sheets are used as row conductor sheet and column conductor sheet.
- (d) Row and column lines are made on the plastic or rubber sheet using silver or some other conductor ink.

4. (b) internal Modem



The internal modem is a stand-alone board that plugs directly into an ISA or PCI expansion slot.

It contains its own Universal Asynchronous Receiver/Transmitter (UART).

A modulator Circuit converts the serial data from the computer into audio signals to be transmitted over telephone lines. This modulated audio is then coupled to the telephone line. The signal passes through telephone jack (RJ-11) connector at the rate of the modem to the telephone line.

On the receiver side, signals received from the telephone line is translated into serial data. The telephone interface separates the received signals and passes them to the demodulator. After demodulation the resulting serial data is passed to UART, which in turn converts the serial bits into parallel words that are placed on the system's data bus.

The telephone interface also generates Dual Tone multi Frequency (DTFM) dialing signals needed to reach a remote modem. When the remote modem dials

in, the telephone interface detects the incoming signal and alerts the UART to begin negotiating a connection.

The telephone interface drives a speaker. During the initial stages of modem operation the speaker is used to hear the dial tone, dialing signals, and audio negotiation between the two modems. Once the connection is established, the speaker is disabled.

The controller circuit manages the overall operation of the modem. It switches the modem between the control and data operating modes. The controller accepts commands from the modulator that allow the modem characteristics and operating parameters to be changed.

In the event of power loss or reset conditions default modem parameters can be loaded from NVRAM. Permanent changes to modem parameters are stored in the NVRAM.

4. (c) The signal voltages for following colors of ATX connectors :

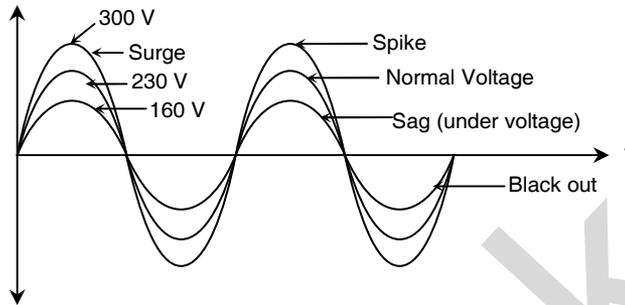
- i) Red +5V DC
- ii) Black Gnd
- iii) Orange – 3.3 V DC
- iv) Purple +5V DC (standby voltage)

4. (d) Beep indicators in POST

	Error Indication	Failing sub system	Fault clues/Reasons
1)	Short beep	Normal post, system OK	
2)	2 short beeps	POST error	Error code shown on screen
3)	No beep	Power supply System board problem DRAM DIMM on	Fuse blown, loose connections, no output. Processor, ROM, Northbridge, Southbridge. DIMM is not properly inserted in slot.
	motherboard speaker	Disconnected speaker.	
4)	Continuous beep	Power supply, system board or keyboard problem.	Improper output voltages of SMPS, DIMM fails, clean and reset the DIMM and check the keyboard connection.
5)	Repeating short beeps.	Power supply, system board or keyboard problem.	Check power supply connections & output voltages, system board & keyboard connection.
6)	1 long, 1 short beep	Motherboard problem	Motherboard
7)	1 long, 2 Short beeps	Display adapter problem (MDA or CGA)	6845 in display adapter video buffer RAM, I/O port logic in display adapter.

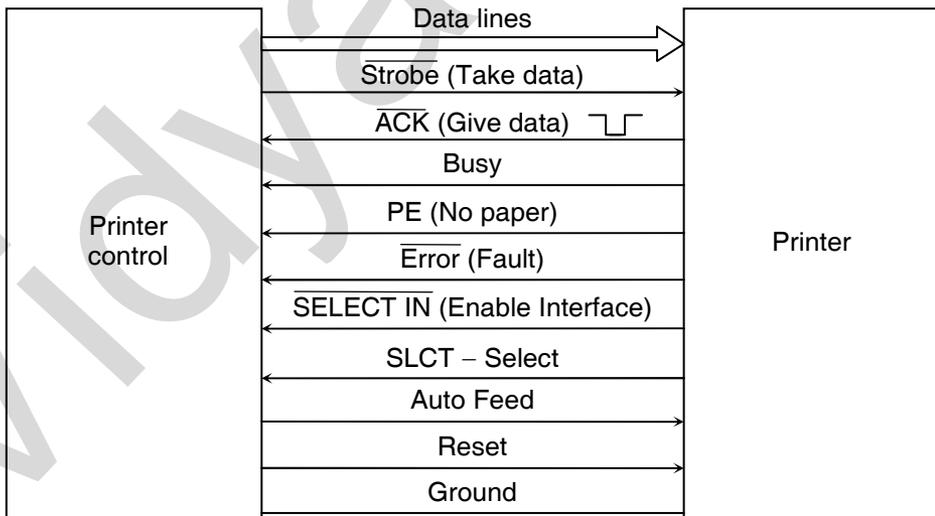
8)	1 long, 3 short beeps	Enhanced Graphics Adapter (EGA)	Check EGA Adapter.
9)	3 long beeps	Keyboard problem.	Check 3270 keyboard card.

4. (e) Power Line consideration for PC



- i) **Brownout** : Brownout is the low voltage condition that can be present even for several hours. This is often created when the power demand exceeds the capacity of the power generator.
- ii) **Blackout** : Blackout is the complete no power condition. Sometimes sudden power failure can bring about wastage of time, money and resources.
- iii) **Surge** : These are overvoltage that last for more than one cycle. Surges are caused when some heavy electrical load is suddenly switched off.
- iv) **Spikes** : Spikes are very high voltage, split second events that can disrupt the operation of electronic devices such as computers.

4. (f) Centronics Interface



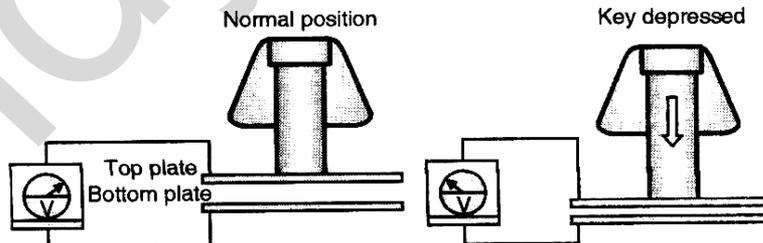
- **Signals from PC-Printer** : There are 12 signals from PC to Printer. Out of these, 8 signals are data bits and 4 signals are control signals.
- The control signals are :
Strobe, INIT, SLCT IN, AUTOFEED XT. All control signals are low active.

- Strobe : The printer should take the data when this signal is low.
- INIT : When INIT is low, the printer resets its electronics logic and clears the printer buffer.
- SLCT IN: It is an interface enable signal. when the signal is low, the printer responds to signals from controller.
- AUTOFEED XT: After printing every line, printer will provide one line feed automatically if the signal is low. This type of line feed is known as hardware line feed. Signals from Printer to PC There are 5 signals from the Printer to PC. These are ACK, Busy, PE, SLCT, and Error.
- Signals from Printer to PC There are 5 signals from the Printer to PC. These are ACK, Busy, PE, SLCT, and Error.
- *ACK* : is acknowledgement for Strobe signal from the PC. When active, it indicates that the printer has received data sent by the PC and the Printer is ready to accept next data type.
- *Busy* : When busy is high, it indicates that the printer is busy and cannot receive data. This signal becomes high under any of the following four conditions
 - 1) On receiving Strobe active
 - 2) During printing operation
 - 3) When printer is in offline status.
 - 4) When printer senses some error condition.
- *PE* : When PE signal is high, it indicates that there is no paper in printer. With torn or absence of paper.
- *SLCT* : Printer is selected and logically connected to the Pc. Error: This indicates that there is error in printer. Following may be the reasons:
 - 1) Mechanical fault or electronic fault.
 - 2) Printer is offline
 - 3) Paper Out

5. (a) Types of Key Switches in Keyboard are :

- | | |
|-----------------------|------------------------|
| (a) Capacitive switch | (b) Membrane switch |
| (c) Mechanical switch | (d) Rubber dome switch |

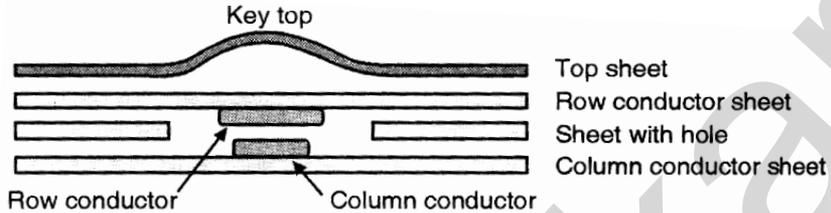
(a) Working principle of Capacitive switch



This is one of the most common keyboard switch type as shown. In this type of switches have two plates of the capacitor are closer when the key is pressed. When the plates are brought closer or moved away, the capacitance of the switch is changed can be detected by measuring the voltage change across the switch using some sense amplifier. The sense

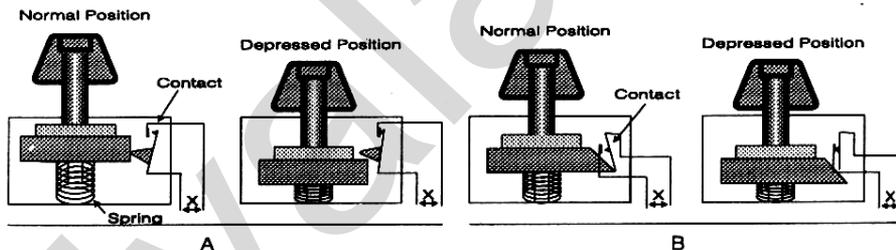
amplifier will receive one voltage when the switch is in open position. These voltages are converted into proper logic signals to inform the computer about the open or close position of the switch. These switches have a normal lifespan of about 20 million keystrokes.

(b) Working principle of Membrane Key switch



- 1) It is a multi-layer plastic or rubber assembly.
- 2) It is used as keyboard in video game machines, calculators, medical instruments, cash registers etc.
- 3) Two rubber or plastic sheets are used as row conductor sheet and column conductor sheet.
- 4) Row and column lines are made on the plastic or rubber sheet using silver or some other conductor ink.

(c) Working principle of Mechanical Key switch



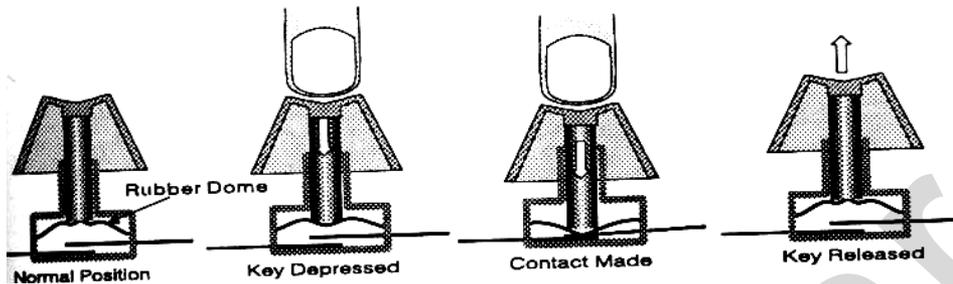
Two metal pieces or contacts are kept in open position and moved into closed position when switch is pressed.

- When the switch is in normal position the contact is open, when the switch is pushed the contact closes, and the closure is sensed by the keyboard interface.
- After some use contacts become oxidized or dirty and make the switch useless.
- Gold plating on these contacts is done to improve the life span of the switch.
- Normal life span of high quality switches is about 1 million keystrokes.

(d) Working principle of Rubber dome switch

Dome like rubber structure keeps the key in up position.

- When the key is pressed, the dome collapses and joins the two contact points.
- When key is released, the dome goes back to its normal shape, pushing the key into normal up position and breaking the contact.



5. (b) Processor Modes

A processor can operate in several different modes. The processor mode controls how the processor sees and manages the system memory and the tasks that use it.

1) Real Mode (8086 mode)

Original IBM PC could address only 1 MB of RAM as it had only 20 address lines. It could execute 16 bit instructions using 16 bit internal registers. Example : DOS operating system. When a processor is running in real mode it has the advantage of speed but it accesses memory with some restrictions.

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Software of this type is usually single tasking – only one program can run at a time. No built in protection exists to keep one program from overwriting another program or even the operating system in the memory.

2) Virtual Real Mode

It is the (virtual) real mode 16 bit environment that runs inside 32 bit protected mode. E.g. When a DOS prompt window is run under windows a virtual real mode session is created. Any program running in virtual real mode can access up to only 1MB of memory, which that program will believe is the first and only megabyte of memory in the system. All Intel and Intel compatible processors power up in real mode. If 32 bit operating system is loaded, it automatically switches the processor into 32 bit mode and takes control from there. Some of the 16 bit applications misbehave in the 32 bit mode. For example, diagnostic software. In such cases the application can be run on Pentium 4 processor by booting the system using a DOS floppy. A protected mode OS can create multiple virtual mode machines. Each machine gets its own 1 MB of memory.

5. (c) Frequency modulation (FM)

- Its used for storing data on magnetic recording surface.
- Its also known as single density recording method.
- In FM a clock pulse is written at the beginning of each bit cell.
- The data pulse is written at the center of the bit cell.

- If the data is 1 ,then data pulse is present.
- If the data is 0 ,then no data pulse.
- Each bit cell is of 4 micro-sec duration for floppy disk.

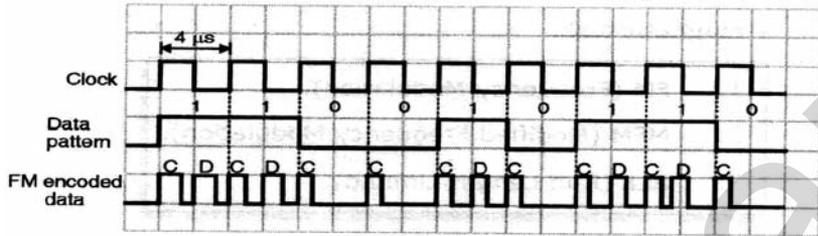


Fig. 1 : FM recording technique.

- For Binary digit 1 is stored two pulses PP
- For binary digit 0 is stored one pulse and one No Pulse (PN)
- For example:
To stored 101011 ..

1	0	0	1
PP	PN	PN	PP

Modified Frequency modulation (MFM)

- Its reduce number of pulses.
- Its also called as double density recording method.
- In MFM clock pulse is not present at the beginning of every bit cell.
- When data is 1 ,there is no clock pulse, only the data pulse is present at the center of the bit cell.
- When data is 0 ,following a 1 in previous bit cell neither clock pulse nor data pulse is written.
- When data is 0 ,following a 0 in previous bit cell then clock pulse is written at the beginning of the current bit cell ,no data pulse is written in the bit cell.
- Its used 2 micro-sec.
- Disk capacity is doubled in MFM.
- For binary data 1- is stored as NP.
- For Binary data 0 preceded by 0 is stored as PN.
- For Binary data 0 preceded by 01 is stored as NN.
- We stored 1001 using MFM as

1	0	0	1
NP	NN	PN	NP

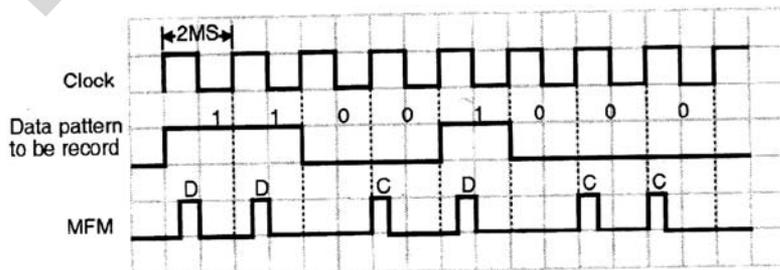
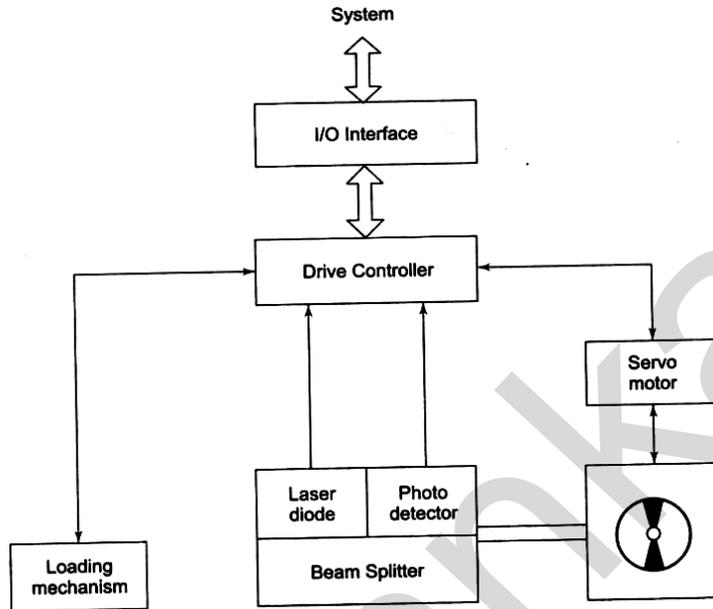


Fig. 2 : MFM recording technique.

6. (a) Construction of CDROM drive



The CD-ROM drive reads the data on the CD and sends the information to the interface connector (expansion board) attached to the computer motherboard. The information then travels to the CPU for processing to make video, text or sound. The CD recording method makes use of optical recording, using a beam of light from a minute semiconductor laser. Such a beam is of low power (milli watts) but the focus of the beam can be a very small point so that low melting point materials like plastics can be vaporized by a focused beam. Turning the recording beam onto a place on a plastic disc for a fraction of a millionth of a second will therefore vaporize the material to leave a tiny created pit, about 0.6 μm (1 μm - 1 millionth of a meter, equal to one thousandth of a millimeter) in diameter a human hair e.g. is around 50 μm in diameter. The depth of the pits is also very small of the order of 0.1 μm . if no beam strikes the disc, then no pit is formed, so that we have here a system that can digitally code pulses into the form of pit or no pit. Reading a set of dimples on a disc also makes use of semiconductor laser, but of much lower power since it need not vaporize material. The reading beam will be reflected from the disc where no dimple exits, but scattered where there is a dimple. By using an optical system that allows the light to travel in both directions to and from the disc surface, it is possible to focus a reflected beam onto a detector, a photodiode and pick up a signal when the beam is reflected from the disc. There will be no signal when the beam falls onto a pit. The output from the detector is the digital signal that will be amplified and then processed into an audio signal.

6. (b) Give the eight specifications of blue ray disk with typical value.

Specifications	Value
Capacity (Single Layer)	23.3GB/25GB/27GB
Capacity (Dual Layer)	46.6GB/50Gb/54Gb

Laser wavelength	405nm (blue-violet)
Lens Numerical Aperture	0.85
Cartridge dimensions	Approx 129X131X7mm
Disc Diameter	120mm
Disc Thickness	1.2mm
Optical Protection Layer	0.1mm
Tracking Pitch	0.32 μ m
Shortest Pit Length	0.160/0.149/0.138 μ m
Recording Density	16.8/18.0/19.5 Gb/Sq. In
Data transfer rate	36Mbps
Recording Format	Phase Change Recording
Tracking Format	Groove Recording
Video Format	MPEG2

6. (c) Need of Cache Memory

- 1) With each new model the processor speed has increased, but the speed of memory chip has not increased.
- 2) CPU has to wait for data from memory.
- 3) High speed RAM cannot be used as main memory as they are very costly.
- 4) Hence a small amount of high speed memory is used between main memory and CPU.

Types of cache memory

L1 cache

- The L1 cache also called internal or integral cache is always a part of the processor chip.
- L1 cache always runs at full processor speed.
- It was the fastest cache in the system.
- L1 cache was originally 8 KB.

L2 cache

- The L2 cache originally called external cache because it was external to the processor chip when it was introduced.
- It was present on the motherboard and used to run at CPU bus speed.
- To improve the performance of the system, L2 cache was directly incorporated as part of the processor die.
- L2 cache was originally 128 KB.

L3 cache

- The L3 cache has been present in high end work stations and servers such as Xenon and Itanium.
- Pentium 4 Extreme Edition was the first desktop PC processor with L3 cache.
- Later Editions of same processor were introduced with larger L2 cache rather than L3 cache.

