

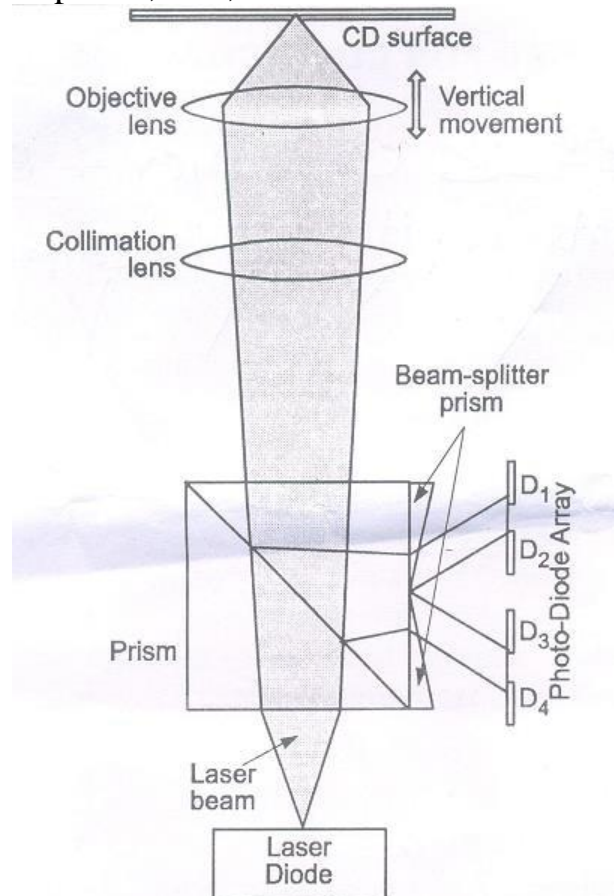
## TOPIC : CD PLAYER

### CD – MATERIAL USED, SIZE AND CAPACITY.

[Q] List material used in CD player & explain any one of them.

Different components used for CD mechanism.

1. CD-Pick-up assembly
2. CD Lens :
  - Collimation lens
  - Concave lens
  - Objective lens
  - Cylindrical lens
3. Gear system
4. Drive motors
  - Tray, loading motor
  - Slide, sled, feed motor
  - Spindle, disc, turntable motor.



Optical arrangement in a single-beam radial tracking pick-up assembly :

In the optical pick-up unit, the laser diode emits laser beam from a small point

into an elliptical or conical distribution. This beam is passed through various prism and lens to form a very small diameter light beam on the disc surface at the centre of the track.

The objective lens is controlled by the tracking and focusing coil to keep the beam focused on the CD and to keep the condensed beam at the centre of the track.

This laser beam is reflected back by the flat area and the pits on the disc surface. This reflected beam is applied to a group of photo-diodes through objectives lens, collimator lens and some prism arrangement.

These photo-diodes induce voltage according to the reflected beam falling on it. Focus error and tracking error voltage generated by this photo-diode array is applied to the tracking and focusing coil to control the objective lens and data signal generated by this photo-diode array is sent to an amplifier to amplify the data signals

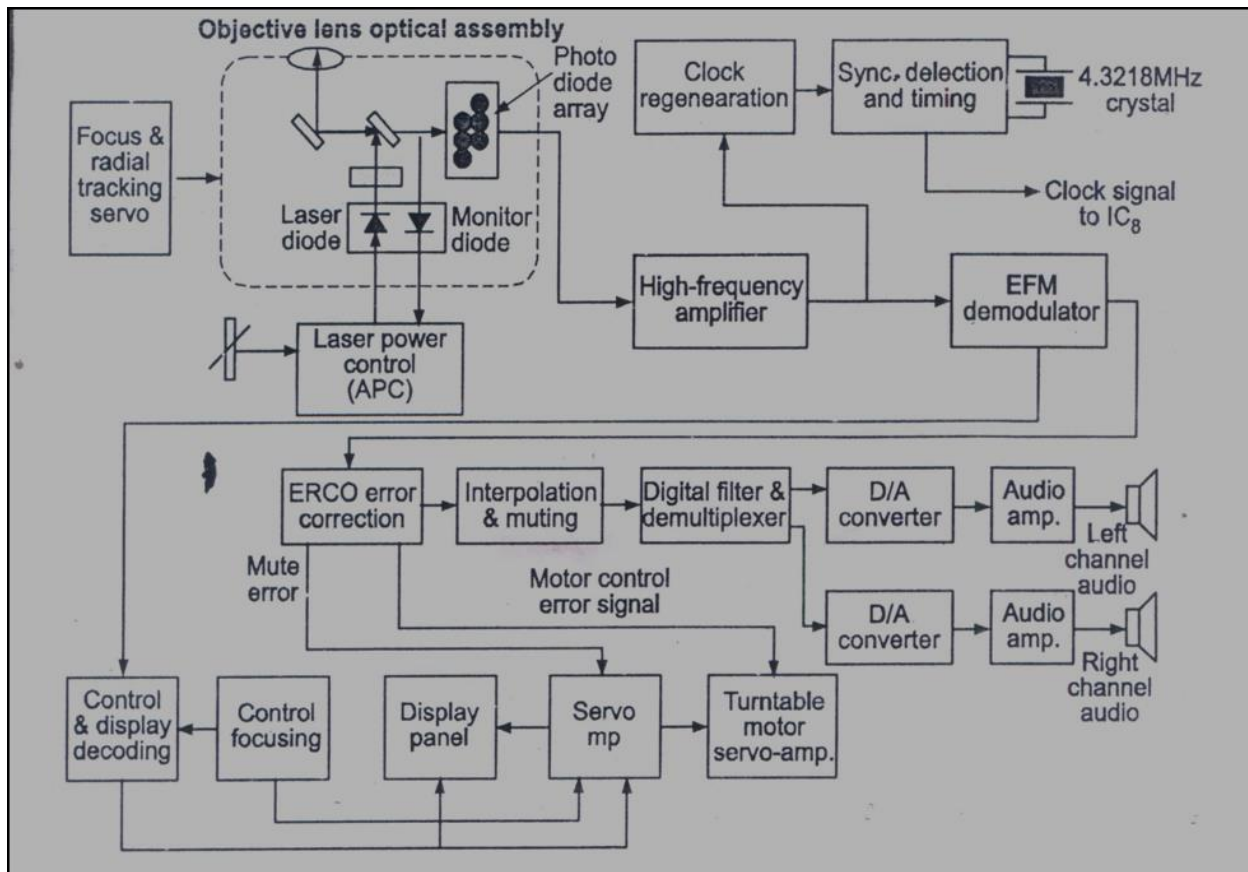
picked-up from the disc. Finally, the output from the amplifier is processed to produce the audio signal stored on the disc surface.

In a CD player the following type of optical assemblies are used:

- Single-beam radial tracking
- Single-beam linear/straight line tracking
- Three-beam linear/straight line tracking

## BLOCK DIAGRAM AND OPERATION OF CD PLAYER.

[Q] DRAW NEAT LABELLED BLOCK DIAGRAM OF CD PLAYER.



**CLV:** The CD player is also known as CLV or constant linear velocity system. In a CLV device such as the CD player the rotational speed of disc player is adjusted with movement of reading mechanism on the disc surface. This speed is changed to maintain constant linear velocity i.e. the signal on the disc surface always moves at constant speed of 1.3 m per second under the pick-up head.

**Half-Full Memory:** This half –full memory circuit makes the disc to maintain a constant linear velocity when the reading mechanism moves from outer tracks of disc to inner tracks or from inner tracks to outer tracks on disc surface.

**Decoding CD:** During the decoding, the digital data on the disc surface is read by the decoding circuit and is converted Into the analog and 0 signal required to drive the speakers and regenerate the stored music.

**Optical pick-up:** the signal stored on the CD surface as pits and flat areas are first picked up by the optical pickup made of lens assembly prism, photo detectors and laser diodes assembly in the optical pick-up unit.

**High frequency amplifier:** The signal is very weak so it is amplified by a high frequency RF amplifier circuit to bring signal to a proper level. This amplified and filtered high-frequency signal contains audio signal as well as synchronization signal in 14-bit EFM (eight to fourteen modulated) format, this signal is sent to an EFM demodulator circuit.

**EFM Demodulator:** The EFM demodulator separates the modulated data and the timing signal from the signal received at its input. It also removes the additional coupling bits and convert the 14-bit EFM symbol to actual 8-bit data. The amplified and filtered EFM signal from high frequency amplifier is also given to clock generation circuit to synchronize detecting and timing circuit. These circuits are used to recover the bit clock and sync pattern data .The timing separated by this system is used to provide timing signal to the system.

**ERCO Circuit:** demodulated data from EFM demodulator is send to error correction (ERCO) circuit. The demodulated data signals also send to control and display decoding circuit, which recovers the control and display signal received from CD.

**Interpolation and muting:** The ERCO circuit is used for error detection and correction purpose. Any error found in the incoming data signal is send to interpolation and muting section by the

ERCO circuit. The interpolation and muting section uses the following methods to correct error found in data stream read from the disc.

- Muting
- Last word held
- Linear Interpolation

**Muting:** In muting, when error is detected in the data stream , the player will mute (silence)the sound is not to send speaker .

**CLV using the Clock Signal:** The ERCO also responsible for maintaining constant linear velocity of CD rotation motor , For this , The TRCO circuit compare the clock signal derived from the incoming data with reference clock frequency.

**De- interleaving: Signals** from the ERCO contains audio signal in the interleaved format. before doing any further operation on this signal, it must be interleaved. The signal Is then de-interleaved in the interpolation and muting section to restore the original sequence of information.

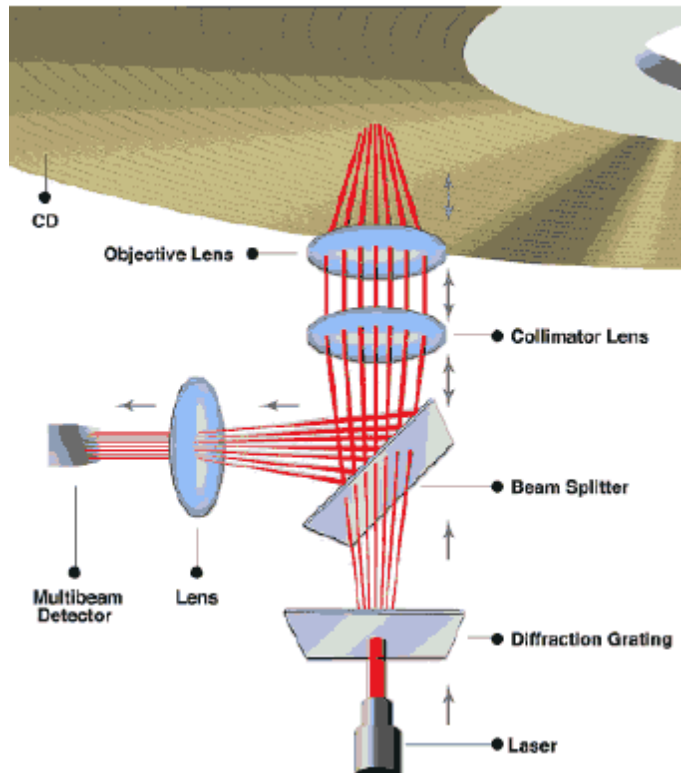
**Digital Filter and De-multiplexer:** The de-interleaved and regenerated is then send to digital filter and de-multiplexer , where it is filtered and separated in to left and right channel data. This circuit removes any effect of sampling frequency from the data signal , which would appear as interference in the form of aliasing noise in analog signal.

**Oversampling:** During digital filtering oversampling method is used to remove both problems of aliasing noise and quantization error.

**D/A convertor:** The output from digital filter and de-multiplexer circuit is send to D/A convertors. The right and left channels are processed by different D/A convertors. These convertors convert the 16-bit digital signal into the original analog audio signal. Because of the over sampling, done in the digital filter and de-multiplexer circuit simple low-pass filter is used following the D/A process.

**COMPONENT USED FOR CD MECHANISM: CD PICK-UP ASSEMBLY, GEAR SYSTEM, DRIVE MOTORS, CD LENS.**

**[Q]With the help of neat sketch, describe working of `pickup unit' of a CD player**



The pick-up assemble consist of –

- A low power laser diode to illuminate the CD tracks.

Lens and prism arrangement to direct the laser beam to the CD surface and to direct the reflected laser beam towards photodiode array.

- A photodiode array to obtain data, focus and tracking signal from the reflected laser beam.
- Focus and tracking coils to focus the beam to the CD surface and to move the assembly to proper track across the disc surface.

**State the function of tray motor and slide (feed) motor.**

**Tray (carriage) motor:** When the open/close switch is pressed, the carriage motor moves the CD tray in and out for loading and unloading the CD. Thus the function of this motor is to „push out“ or inject as well as to push in the CD tray.

**Feed motor:** This motor moves the optical pick up unit from the centre to the outer edge of the disc on sliding rods. Some players have pick up motors that travels in a radial or semicircle fashion. This motor keeps an objective lens constantly in line with the centre of the optical axis or track.

The feed motor may have a fast forward and fast reverse mode operation. The fast forwarding and fast rewinding of the slide motor can be used by switching for smoother accessing. When program search is there, the motor is rotated at high speed.

In such high speed access, the servo signal is cut off and a large drive voltage is applied to the feed motor, so that the pick-up assembly is moved at a high speed. All this functions are controlled by PLL and servo processor according to user selection.

**[Q] State the functions of various drive motors in CD player.**

**(1.5 M disc, spindle or turntable motor, 1.5 M slide, feed or sled motor, 1M tray or loading motor)**

Different types of motors used in CD players are:

- Tray loading or carriage motor,
  - Slide sled feed motor and
  - Spindle, disc, turn table motor.
- There are three basic motors used in the CD player. CD players with auto CD changer or the table top changer may have up to five different motors or some portable or combination CD and cassette player may have only two motors but three motors used In CD players are most common.
- The tray or loading motor moves the CD tray in and out for loading and unloading the CD when the open/close switch is pressed.
  - A disc, spindle or turntable motor rotates the CD at a variable speed. The disc motor rotates faster at the beginning and slows down as the laser assembly moves toward the outer edge of the CD.
  - The slide, feed or sled motor moves the optical pickup unit from the center to the outer edge of the disc on sliding rods. Some players have a pick-up motor that travels in a radial or semicircle fashion.

**[Q] LIST THE DIFFERENT LENSES USED IN CD PLAYER. STATE THEIR FUNCTIONS**

Types of Lenses used in CD player.

1. Collimation lens
2. Concave lens
3. Objective lens
4. Cylindrical lens

**Collimation lens:**

□ The collimator lens is used to produce completely parallel beams of laser. This lens together with the objective lens is used to focus the laser beam to the disc surface.

**Concave lens:**

□ In single-beam linear optical block assembly this concave lens is used to concentrate the laser beam, reflected from the disc surface, onto the photodiode array. This lens is mainly used to improve the sensitivity of the photodiode array.

**Objective lens:**

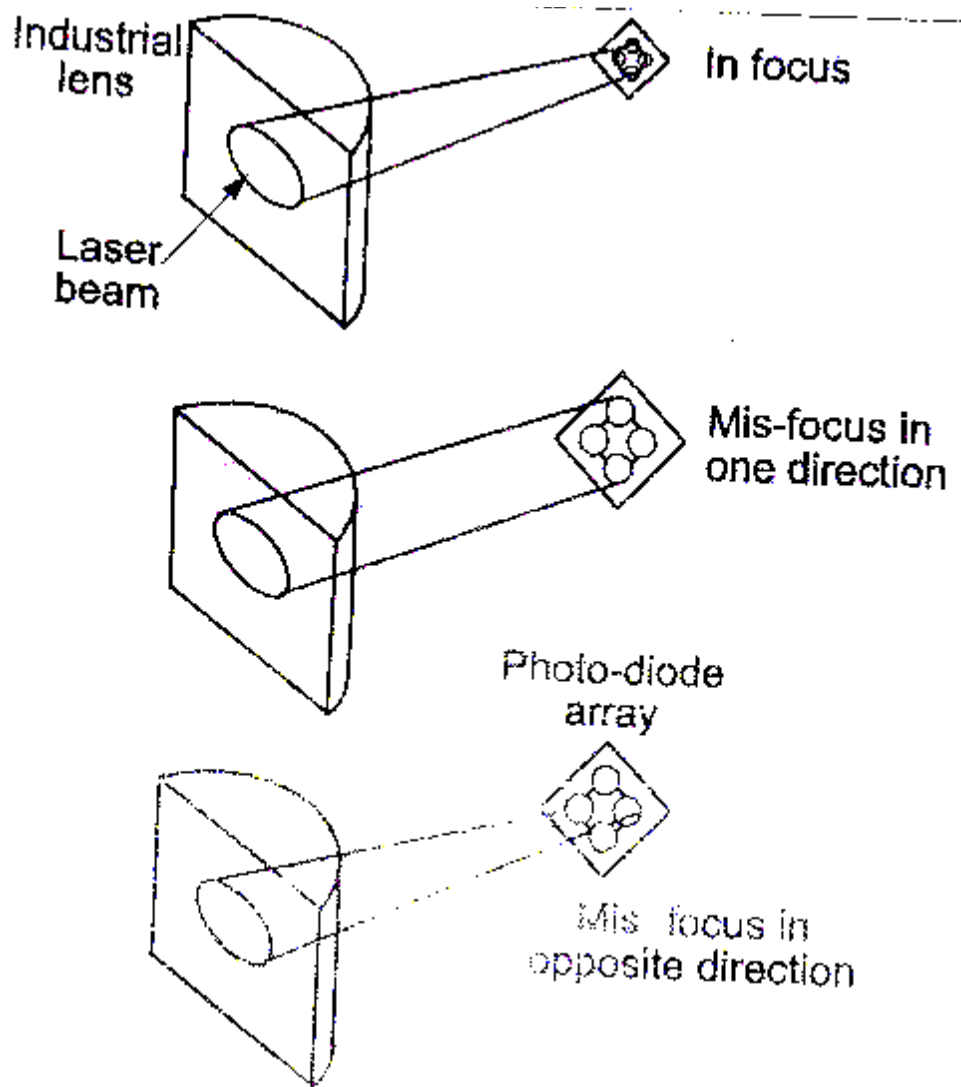
□ Before hitting the disc surface, the laser beam comes out of the pickup assembly through an objective lens. The objective lens is used to focus, laser beam onto the CD surface and to receive the reflected laser beam.

□ This lens is moved up/down to achieve the focus of the laser beam on the disc face. The objective lens is always kept in focus using a system similar to the voice system used in the audio speakers.

□ It is also moved horizontally in the linear pickup assembly to keep the laser in proper track. In players that used the radial tracking method the objective is unit does not move horizontally (laterally).

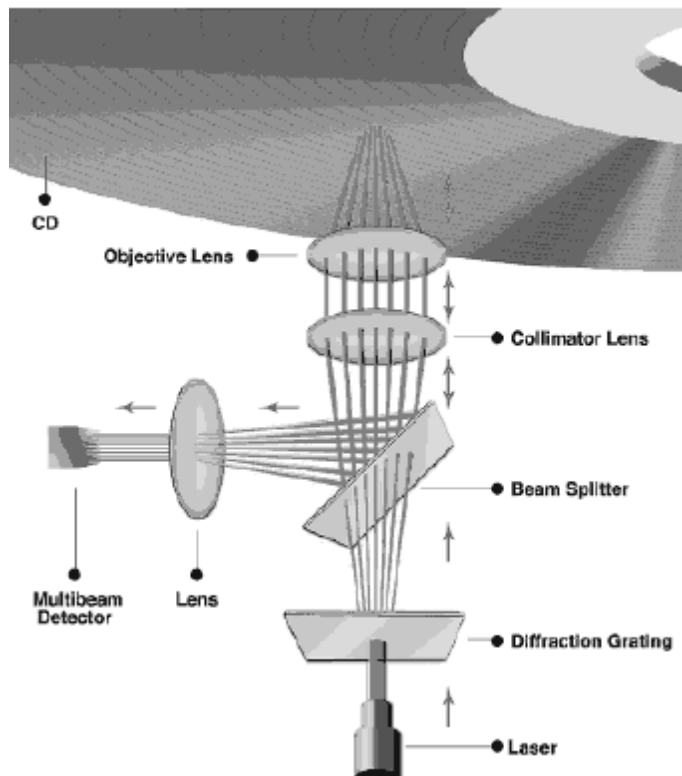
**Cylindrical lens (in Three-Beam Linear Optical Blocks):**





- The main action of this lens is to enable the reflected beam from the CD to assist in creating the necessary signal to make sure that focus of the laser beam on the playing surface the disc is maintained.
  - As shown in the fig. when the beam is correctly focused a circular beam of light will land on the four photodiode elements. If the beam becomes out of focus the cylindrical lens will distort the beam elliptically.
  - As shown in the fig. the distortion depends upon the direction of mis-focus. This distortion is known as astigmatism.

**[Q] DESCRIBE THE WORKING OF PICK-UP ASSEMBLY OF CD PLAYER WITH THE HELP OF NEAT SKETCH**



**Working:**

- A low power laser diode to illuminate the CD tracks.
- Lens and prism arrangement to direct the laser beam to the CD surface and to direct the reflected laser beam towards photodiode array.
- A photodiode array to obtain data, focus and tracking signal from the reflected laser beam.
- Focus and tracking coils to focus the beam to the CD surface and to move the assembly to proper track across the disc surface.
- Some optical units do not contain the tracking coil, for example, the single-beam radial tracking assembly, this is explained in latter sections.
- In the optical pickup unit, the laser diode emits laser beam from a small point into an elliptical or conical distribution. This beam is passed through various prism and lens to form a very small diameter light beam on the disc surface at the center of the track.
- The objective lens is controlled by the tracking and focusing coil to keep the beam focused on the CD and to keep the condensed beam at the center of the track.
- This laser beam is reflected back by the flat area and the pits on the disc surface. This reflected beam is applied to a group of photodiodes through objectives lens, collimator lens and some prism arrangement.

- These photodiodes induce voltage according to the reflected beam falling on it. Focus error and tracking error voltage generated by this photodiode array is applied to the tracking and focusing coil to control the objective lens and data signal generated by this photodiode array is sent to an amplifier to amplify the data signals picked-up from the disc.
- Finally, the output from the amplifier is processed to produce the audio signal stored on the disc surface.

**FUNCTION OF FRONT PANEL CONTROLS .  
FUNCTION OF REMOTE CONTROL TRANSMITTER AND RECEIVER  
UNIT USED IN CD PLAYER.**

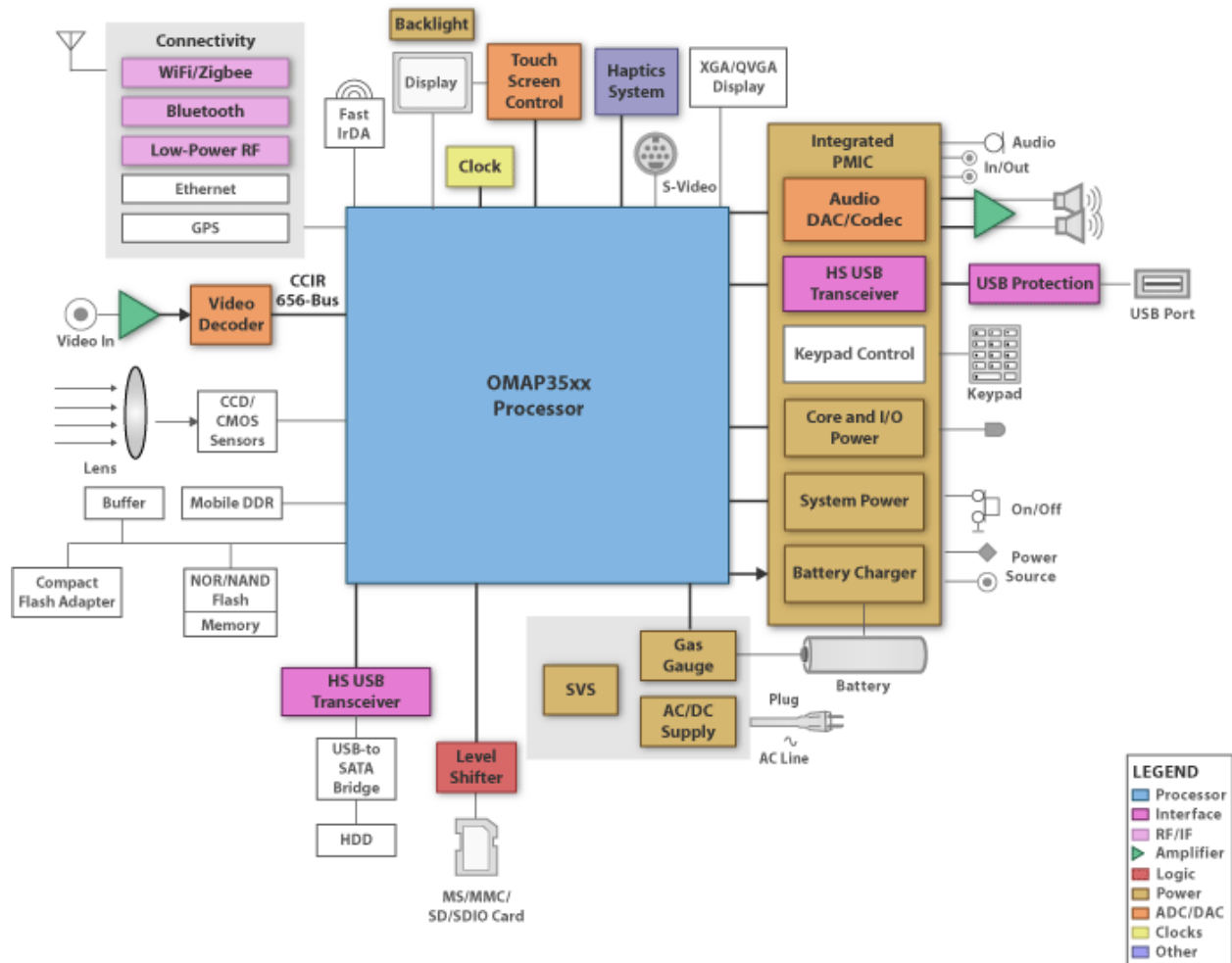
**▪ ADVANTAGEOUS OF VACUUM FLORESCENT**

**STATE ANY FOUR ADVANTAGES OF VACUUM FLUORESCENT  
DISPLAY.**

- Displays the pitch of the channel, band etc.
- Helps the listener to adjust the pitch of his interest by seeing the display.
- Helps to know the voice band when using the karaoke system.
- Uniform brightness, low cost etc.
- In addition to ten numerals, the display can be used to show letters including punctuation.
- It gives hexadecimal encoding for display the digits 0 to F.
- To remove the ambiguity letter „B’ is small „b’ and number „8“ is in 7 segment display, otherwise both would have looked same.
- It can give short message giving status information in CD player like “no disc” or “error” etc.
- The fluorescent numbers and messages can be seen in the dark also.

## Q1: DRAW THE BLOCK DIAGRAM FOR DVD PLAYER

Note : you can explain this block diagram easily as what is input ,through what it is processing and what is output.take help of cd player to understand.



Q1: Explain DVD player working .



DVD's have pits and bumps in their track which holds the information that is required to be played. This information can be a video, audio or a mixture of both. When a DVD player reads this data, the smooth surface is usually taken as a '0' and pits are usually taken as a '1'.

In order to create as well as read these data, a red laser with a wavelength of 600 nanometers. This is about 180 nanometers lesser than the wavelength of CD, which enables it to have a higher density of pits. Thus the size of the DVD increases. Though the first released DVD's were only a single layer, 2 layered discs have been released nowadays. Single layer can hold only up to 4.7 GB of data while double layered DVD can hold up to 17 GB of data. The DVD design is similar to a CD a reflective silver layer in the centre and a semi-transparent gold layer on the top of it.

A DVD does not have the capacity to hold hi-def movies. So a MPEG-2 compression system is introduced. As this is used, the data will be encoded onto

the DVD as elements of the changing frames. This has to be successfully decoded and decompressed by the DVD player

The pits and bumps in the DVD are hit by the laser from the optical mechanism of the DVD player. This laser will be reflected differently according to the change of pits and bumps. Though the laser hits a single spot, the DVD moves in a circular motion so that the entire area is covered. Mirrors are also used to change the spot.

These reflected laser beams are then collected by a light sensor (eg. photo-detector) which converts the different signals into a binary code. In short, the optical system helps in converting the data from the DVD into a digital code.

The binary signal is then sent to a Digital to Analog converter which will be setup in the PCB. Thus the corresponding analog signal of the DVD is obtained. The PCB also has amplifiers which amplify the signal and then sends it to the graphic and audio systems of the computer/TV.