5425007

B.Tech. DEGREE EXAMNATION, JANUARY 2023.

Fifth Semester

Electronics and Communication Engineering

Elective: CONSUMER ELECTRONICS

PART A- (10 *2=20)

Answer ALL the questions.

1. **What is crystal loudspeaker? (Model)**
   Crystal Loudspeakers are the transducers that convert electrical energy into airborne acoustical energy. An ideal loudspeaker would be capable of faithful reproduction of transients a; id steady input signals and should also produce non directional radiation pattern.
2. **List the characteristics of microphones.(INT 1)**
   - Output level
   - Frequency response
   - Output impedance
   - Directivity
3. **List the components of a remote control.**
   MCU (Microcontroller unit),
   RF Tx
4. **Define chrominance.(INT 1)**
   Chrominance is the signal used in video systems to convey the color information of the picture, separately from the accompanying luminance signal. Chrominance is usually represented as two color-difference components: ER-EY, EG-EY, EB-EY.
5. **List the different components used in CD player.**
   A CD player has three major mechanical components: a drive motor, a lens system or pickup head, and a tracking mechanism
6. **State blue ray disc.**
   Blu-ray is **an optical disc format like CD and DVD**. Blu-ray discs can hold more information than other optical media, because of the blue lasers that the disc drives use. A single Blu-ray disc can hold up to 25GB of data.
7. **Illustrate the PBAX switching.**
   A private branch exchange is a telephone system within an enterprise that switches calls between users on local lines, while enabling all users to share a certain number of external phone lines.
8. **Define DECT and UMTS.**
   Digital enhanced cordless telecommunications (DECT) is a digital wireless technology for telephony that is used both for home and business.
   Universal Mobile Telecommunications System (UMTS)
9. **What is a cooking chamber in a microwave oven?**
   The cooking chamber of a microwave oven is always metallic. Even the glass door has a metal grid across it to keep the microwaves inside. This metal chamber may be coated with paint or plastic but it is there nonetheless. Without it, the microwaves would leak out and the oven would be hazardous and inefficient.

10. Define proximity sensors.

A proximity sensor is a device that can detect or sense the approach or presence of nearby objects and for this it does not need physical contact.

PART B- (5*11=55)

Answer ALL questions.

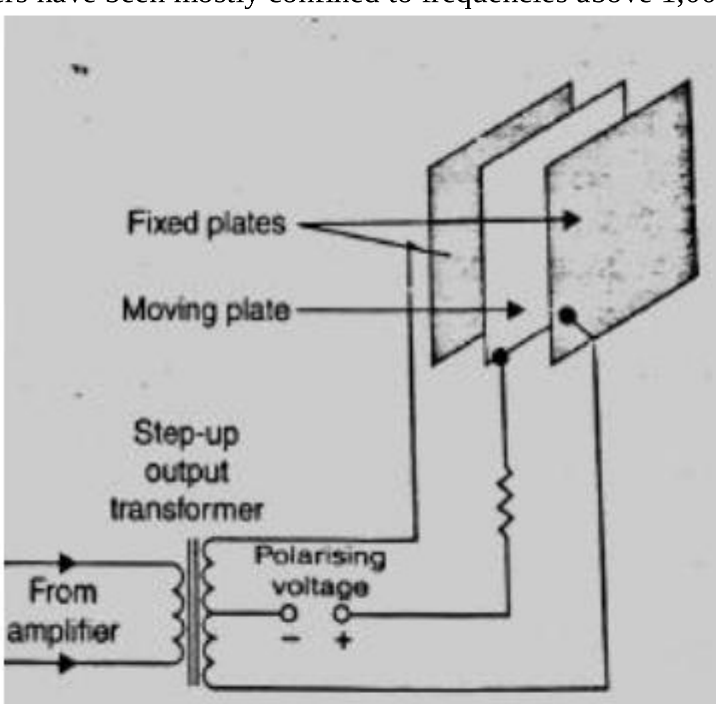
11. **Enumerate in the detail about the differences in Dynamic, Electrostatic and permanent magnet loudspeaker.(MODEL)**

Electrostatic:

Now suppose we apply a 400 V dc audio signal to the speaker. As the positive half cycle of the signal from zero the voltage between the plate's rises from 1,000 V toward 1,400 V and the movable plate bends from its original position toward the fixed plate. As the ac passes its peak and returns to zero, the voltage between the plate's drops from 1,000 V to 600 V. Instead of moving again toward the fixed plate, the movable plate moves farther away. So we have a situation in which the bending of the movable plate is identical to the ac swing and there is no frequency doubling.

A detailed view of a modem electrostatic speaker is shown in Figure.1.10. The practical speaker of today uses push-pull, with a built-in step-up transformer to work from the ordinary 8 ohm amplifier output tap. The polarizing voltage is applied to the centre or movable plate through a resistor that keeps the voltage stable during variations in the signal voltage. The signal voltage is applied to the two outside plates. Because the diaphragm is centered between the two plates that attract it equally, there is no bending when there is no signal. Also, because of the push- pull action the diaphragm can move twice as far in response to signal voltages for the same amount of compression of the dielectric material.

The major weakness of the electrostatic speaker requires the dc bias is that it to be much larger than the applied audio signal. In practical speakers, 1,000 to 1,200 volts may be used. Further, when we get into the bass frequency ranges, a great deal of power would be required to get enough output. To produce such power, the speaker area would have to be very large. So, even though full range electrostatic speakers have been constructed in practical use electrostatic speakers have been mostly confined to frequencies above 1,000 Hz. 11



The step-up transformer and the high voltage polarizing supply are usually built right into the modern electrostatic. Often the electrostatic unit and its matching woofer are sold together as a complete system. Some high class systems use electrostatics to reproduce the high frequencies. Koss uses electrostatics on some of their stereo headphones.

DYNAMIC LOUDSPEAKERS

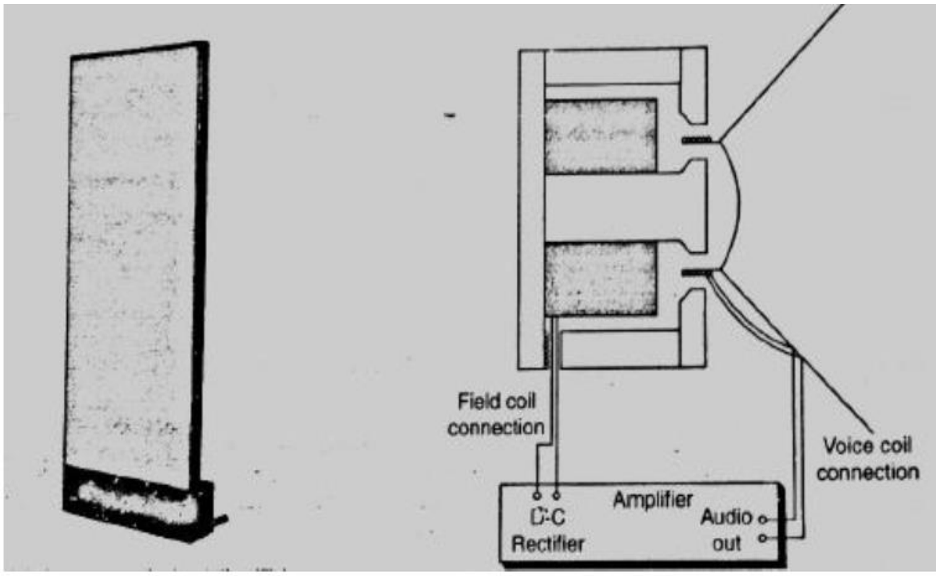
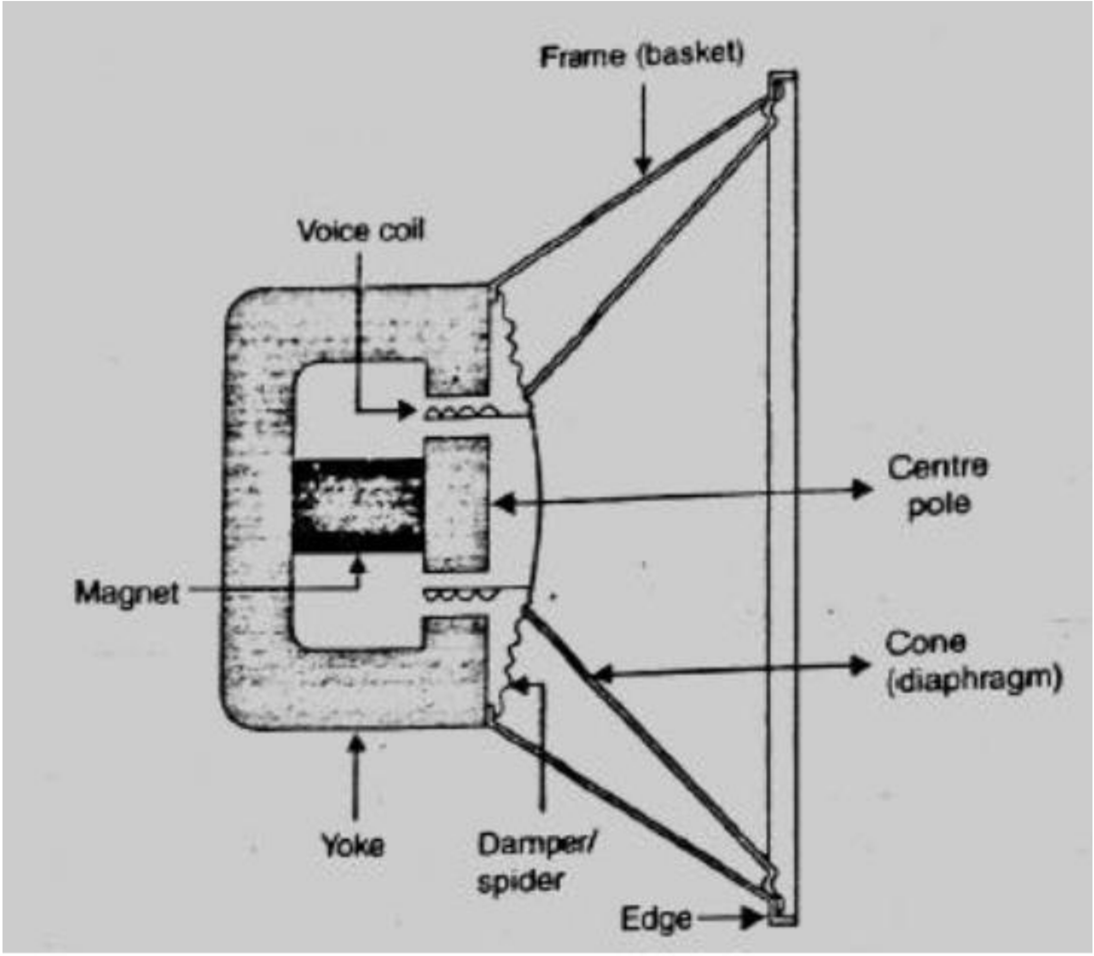


Figure.1.11 (a) a two way electrostatic utilising a separate woofer and tweeter (b) Electrodynamic speaker

There are two varieties of dynamic loudspeakers: electrodynamics and permanent magnet (PM) speakers. Both work in exactly the same way, the difference is in their construction. The electrodynamics speaker has a soft iron magnetic circuit, non-retentive of magnetism, around whose center leg; a large, multilayer field coil is wound, as shown in the Figure.1.11. When dc flows through this field coil, it magnetizes the iron core. A magnetic flux field directly proportional to the strength of the current through the coil is thus set up across the air gap. The iron core is not permanently magnetized; it stays magnetized only as long as current flows through the field coil. Improvements in permanent magnet materials have made the electrodynamics speaker practically obsolete, but some still exist in vintage radios. Note that these use the field coil as part of a choke filter in the power supply, a good example of killing two birds with one stone. The electrodynamics speaker has disappeared completely, so far as hi-fi is concerned, the permanent magnet speaker reigns supreme. 12

PERMANENT MAGNET LOUDSPEAKERS

The most popular type of loudspeaker today is the permanent magnet dynamic type. Because of its comparative simplicity of construction and design, the precision that may be built into it, the ease with which it is interfaced with other equipment, its easy adaptability too many different applications, and its comparative freedom from electrical trouble, the dynamic loudspeaker has found acceptance in all kinds of reproducing systems. It is found in the smallest pocket radios and is a major component of the most elaborate theatre systems (See Figure.1.12).



12. **What is the different type of microphones? Explain carbon microphone in details.**

- Carbon
- Crystal
- Dynamic
- Ribbon
- Capacitor

Carbon Microphones

An inset pattern of carbon granule microphone is in general use for the telephone system: the usual type is a self-contained and sealed microphone which can be readily and completely removed from the telephone instrument. Its operation depends upon the variation in contact resistance of the carbon granules when they are subjected to the pressure changes of sound waves. It follows that this type of microphone does not produce an emf but functions by modulating the current obtained from an external battery.

The essential components of this microphone are two electrodes and carbon granules which are loosely packed in between the electrodes. One electrode is fixed 3 relative to the other which carries a diaphragm to respond the pressure changes of sound waves. Movement of this diaphragm varies the resistance of the granules and so control the line current in accordance with the sound waves reaching the diaphragm. An increase in pressure produces a reduction in resistance and an increase in current. The elementary circuit arrangement is shown in Figure.1.2 Constructional details of the inset carbon microphone are shown in Figure.1.3

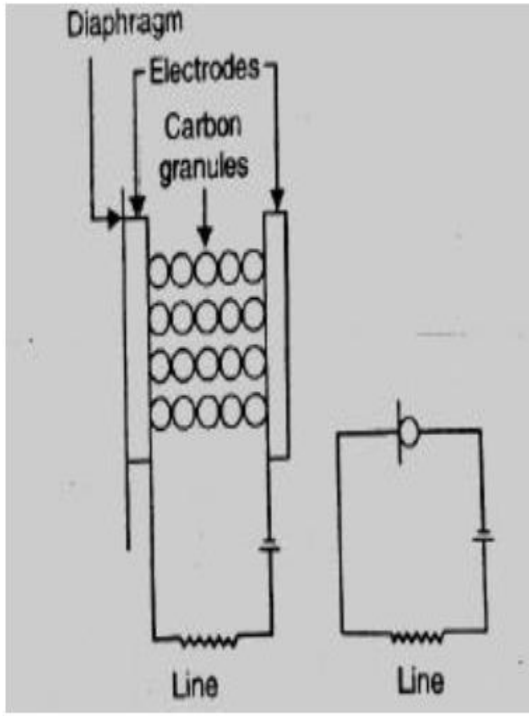


Figure.1.2 Principle of carbon granule microphone

The carbon microphone generates a continuous hiss. This hiss is due to small variations in contact resistance which take place between the carbon granules. With carbon microphones the electrical output is not directly proportional to the sound input level. The practical effect of this non-linear distortion is to produce harmonics of the lower speech frequencies and these harmonics tend to mask higher frequencies normally present in the speech, resulting in loss of clarity or articulation.

The average output level of carbon microphone is of the order of -30dB. The best carbon microphones have a frequency response of approximately 60 to 7000Hz. They are substantially non directional although their high frequency response above 300Hz usually falls at angles exceeding 40 degrees from the front of the microphone.

13. Summarize the basic elements of colour TV communication system.(INT 1)

LEMENTS OF A TELEVISION SYSTEM

Television is an extension of the science of radio communications, embodying ail of its fundamental principles and possessing all of its complexities and, in addition, making use of most of the known techniques of electronic circuitry.

In the case of the transmission and reproduction of sound, the fundamental problem is to convert time ' variations of acoustical energy into electrical information, translate this into radio frequency (RF) energy in -- the form of electromagnetic waves radiated into space and, at some receiving point, reconvert part of the resultant electromagnetic energy existing at that point into acoustical energy.

Broadcast television systems are encoding or formatting standards for the transmission and reception of terrestrial television signals. There are three main analog television systems in current use around the world: NTSC, PAL, and SECAM. These systems have several components, including a set of technical parameters for the broadcasting signal, an encoder system for encoding color, and possibly a system for encoding multichannel television sound (MTS).

INTERLACING

Interlaced video is a technique for doubling the perceived frame rate of a video display without consuming extra bandwidth. The interlaced signal contains two fields of a video frame captured at two different times. This enhances motion perception to the viewer, and reduces flicker by taking advantage of the phi phenomenon effect.

This effectively doubles the time resolution (also called temporal resolution) as compared to non-interlaced footage (for frame rates equal to field rates). Interlaced signals require a display that is natively capable of showing the individual fields in a sequential order. Only CRT displays and Allis plasma displays are capable of displaying interlaced signals, due to the electronic scanning and lack of apparent fixed-resolution.

Interlaced scan refers to one of two common methods for "painting" a video image on an electronic display screen (the other being progressive scan) by scanning or displaying each line or row of pixels. This technique uses two fields to create a frame. One field contains all odd lines in the image; the other contains all even lines.

A PAL-based television set display, for example, scans 50 fields every second (25 odd and 25 even). The two sets of 25 fields work together to create a full frame every 1/25 of a second (or 25 frames per second), but with interlacing create a new half frame every 1/50 of a second (or 50 fields per second). To display interlaced video on progressive scan displays, playback applies interlacing to the video signal (which adds input lag). 25 The European Broadcasting Union has argued against interlaced video in production and broadcasting. They recommend 720p 50 fps (frames per second) for the current production format—and are working with the industry to introduce 1080p50 as a future-proof production standard. 1080p 50 offers higher vertical resolution, better quality at lower bitrates, and easier conversion to other formats, such as 720p50 and 1080i50. The main argument is that no matter how complex the interlacing algorithm may be, the artifacts in the interlaced signal cannot be completely eliminated because some information is lost between frames.

Despite arguments against it, television standards organizations continue to support interlacing. It is still included in digital video transmission formats such as DV, DVB, and ATSC. New video compression standards in development, like High Efficiency Video Coding, do not support interlaced coding tools and target high-definition progressive video such as ultra high definition television.

14. **Write short notes on (a) NTSC. (b) SECAM. (MODEL) NTSC**

NTSC, named after the National Television System Committee, is the analog television system that was used in most of the Americas (except Brazil, Argentina, Paraguay, Uruguay and French Guiana); Burma; South Korea; Taiwan; Japan; the Philippines; and some Pacific island nations and territories (see map).

Most countries using the NTSC standard, as well as those using other analog television standards, have switched to newer digital television standards, there being at least four different standards in use around the world. North America, parts of Central America, and South Korea are adopting the ATSC standards, while other countries are adopting or have adopted other standards. This standard is slowly being replaced by HDTV.

LINES AND REFRESH RATE

NTSC color encoding is used with the System M television signal, which consists of 29.97 interlaced frames of video per second. Each frame is composed of two fields, each consisting of 262.5 scan lines, for a total of 525 scan lines. 483 scan lines make up the visible raster. The remainder (the vertical blanking interval) allows for vertical synchronization and retrace. This blanking interval was originally designed to simply blank the receiver's CRT to allow for the simple analog circuits and slow vertical retrace of early TV receivers. However, some of these lines may now contain other data such as closed captioning and vertical interval time code (VITC). In the complete raster (disregarding half lines due to interlacing) the even-numbered scan lines (every other line that would be even if counted in the video signal, e.g. {2, 4, 6, ..., 524}) are drawn in the first field, and the odd-numbered (every other line that would be odd if counted in the video signal, e.g. {1, 3, 5, ..., 525}) are drawn in the second field, to yield a flicker-free image at the field refresh frequency of approximately 59.94 Hz (actually 60 Hz/1.001). For comparison, 576i systems such as PAL-B/G and SECAM use 625 lines (576 visible), and so have a higher vertical resolution, but a lower temporal resolution of 25 frames or 50 fields per second.

The NTSC field refresh frequency in the black-and-white system originally exactly matched the nominal 60 Hz frequency of alternating current power used in the United States. Matching the field refresh rate to the power source avoided intermodulation (also called beating), which produces rolling bars on the screen. When color was added to the system, the refresh frequency was shifted slightly downward to 59.94 Hz to eliminate stationary dot patterns in the difference frequency between the sound and color carriers, as explained below in "Color encoding". Synchronization of the refresh rate to the power incidentally helped kinescope cameras record early live television broadcasts, as it was very simple to synchronize a film camera to capture one frame of video on each film frame by using the alternating current frequency to set the speed of the synchronous AC motor-drive camera. By the time the frame rate changed to 29.97 Hz for color, it was nearly as easy to trigger the camera shutter from the video signal itself. The actual figure of 525 lines was chosen as a consequence of the limitations of the vacuum-tube-based technologies of the day. In early TV systems, a master voltage-controlled oscillator was run at twice the horizontal line frequency, and this frequency was divided down by the number of lines used (in this case 525) to give the field frequency (60 Hz in this case). This frequency was then compared with the 60 Hz power-line frequency and any discrepancy corrected by adjusting the frequency of the master oscillator. For interlaced scanning, an odd number of lines per frame was required in order to make the vertical retrace distance identical for the odd and even fields, which meant the master oscillator frequency had to be divided down by an odd number. At the time, the only practical method of frequency division was the use of a chain of vacuum tube multivibrators, the overall division ratio being the mathematical product of the division ratios of the chain. Since all the factors of an odd number also have to be odd numbers, it follows that all the dividers in the chain also had to divide by odd numbers, and these had to be relatively small due to the problems of thermal drift with vacuum tube devices. The closest practical sequence to 500 that meets these criteria was $3 \times 5 \times 5 \times 7 = 525$. (For the same reason, 625-line PAL-B/G and SECAM uses $5 \times 5 \times 5 \times 5$, the old British 405-line system used $3 \times 3 \times 3 \times 3 \times 5$, the French 819-line system used $3 \times 3 \times 7 \times 13$ etc.)

SECAM

Just as with the other color standards adopted for broadcast usage over the world, SECAM is a standard which permits existing monochrome television receivers predating its introduction to continue to be operated as monochrome televisions. Because of this compatibility requirement, color standards added a second signal to the basic monochrome signal, which carries the color information. The color information is called chrominance or C for short, while the black and white information is called the luminance or Y for short. Monochrome television receivers only display the luminance, while color receivers process both signals.

Additionally, for compatibility, it is required to use no more bandwidth than the monochrome signal alone; the color signal has to be somehow inserted into the monochrome signal, without disturbing it. This insertion is possible because the spectrum of the monochrome TV signal is not continuous (for most typical video content), hence empty space exists which can be utilized. This typical lack of continuity results from the discrete nature of the signal, which is divided into frames and lines. (Strictly speaking, monochrome video does use the full spectrum, if arbitrary and unconstrained movement of subjects and/or cameras is permitted. Therefore, all of these color systems compromise luma quality to some extent in exchange for the addition of color—i.e. all of these color signals look worse at some time or other than they would if the color signal were absent.)

Analog color systems differ by the way in which infrequently used space in the frequency band of the signal is used. In all cases, the color signal is inserted at the end of the spectrum of the monochrome signal, where it causes less visual distortion (only affecting fine detail) in the uncommon case that the monochrome signal had significant frequency components overlapping the color signal.

In order to be able to separate the color signal from the monochrome one in the receiver, a fixed frequency sub carrier is used, this sub carrier being modulated by the color signal.

The color space is three-dimensional by the nature of the human vision, so after subtracting the luminance, which is carried by the base signal, the color sub carrier still has to carry a two-dimensional signal. Typically the red (R) and the blue (B) information are carried because their signal difference with luminance (R-Y and B-Y) is stronger than that of green (G-Y).

SECAM differs from the other color systems by the way the R-Y and B-Y signals are carried. First, SECAM uses frequency modulation to encode chrominance information on the sub carrier. Second, instead of transmitting the red and blue information together, it only sends one of them at a time, and uses the information about the other color from the preceding line. It uses an analog delay line, a memory device, for storing one line of color information. This justifies the "Sequential, With Memory" name. Because SECAM transmits only one color at a time, it is free of the color artifacts present in NTSC and PAL resulting from the combined transmission of both signals.

This means that the vertical color resolution is halved relative to NTSC. The later PAL system also displays half the vertical resolution of NTSC (i.e., the same as SECAM). Although PAL does not eliminate half of vertical color information during encoding, it combines color information from adjacent lines at the decoding stage, in order to compensate for "color sub carrier phase errors" occurring during the transmission of the Amplitude/Phase-Modulated color sub carrier. This is normally done using a delay line like in SECAM (the result is called PAL D or PAL Delay-Line, sometimes interpreted as DeLuxe), but can be accomplished "visually" in cheap TV sets using PAL-S (PAL simple) decoders. Because the FM modulation of SECAM's color sub carrier is insensitive to phase (or amplitude) errors, phase errors do not cause loss of color saturation in SECAM, although they do in PAL. In NTSC, such errors cause color shifts (hence the "Hue" control on all older NTSC TV sets to adjust the color phase with a constant bias).

The color difference signals in SECAM are actually calculated in the color space, which is a scaled version of the YUV color space. This encoding is better suited to the transmission of only one signal at a time.

FM modulation of the color information allows SECAM to be completely free of the dot crawl problem commonly encountered with the other analog standards. SECAM transmissions are more robust over longer distances than NTSC or PAL. However, owing to their FM nature, the color signal remains present, although at reduced amplitude, even in monochrome portions of the image, thus being subject to stronger cross color even though color crawl of the PAL type doesn't exist.

Though most of the pattern is removed from PAL and NTSC-encoded signals with a comb filter (designed to segregate the two signals where the luma spectrum may overlap into the spectral space used by the Chroma) by modern displays, some can still be left in certain parts of the picture. Such parts are usually sharp edges on the picture, sudden color or brightness changes along the picture or certain repeating patterns, such as a checker board on clothing. Dot crawl patterns can be completely removed by connecting the display to the signal source through a cable or signal format different from composite video (yellow RCA cable) or a coaxial cable, such as S-video, which carries the Chroma signal in a separate band all its own, leaving the luma to use its entire band, including the usually empty parts when they are needed. FM SECAM is a continuous spectrum, so unlike PAL and NTSC even a perfect digital Comb Filter could not entirely separate SECAM Colour and Luminance.

The idea of reducing the vertical color resolution comes from Henri de France, who observed that color information is approximately identical for two successive lines. Because the color information was designed to be a cheap, backwards compatible addition to the monochrome signal, the color signal has a lower bandwidth than the luminance signal, and hence lower horizontal resolution. Fortunately, the human visual system is similar in design: it perceives changes in luminance at a higher resolution than changes in chrominance, so this asymmetry has minimal visual impact. It was therefore also logical to reduce the vertical color resolution.

15. **Sketch composite video signal, label its parts and explain them. (MODEL) COMPOSITE VIDEO SIGNAL**

A signal that contains all three of these components intensity information, horizontal-retrace signals, and vertical-retrace signals is called a composite video signal. A composite-video input on a VCR is normally a yellow RCA jack. One line of a typical composite video signal looks something like the image on this page.

The horizontal-retrace signals are 5-microsecond (abbreviated as "us" in the figure) pulses at zero volts. Electronics inside the TV can detect these pulses and use them to trigger the beam's horizontal retrace. The actual signal for the line is a varying wave between 0.5 volts and 2.0 volts, with 0.5 volts representing black and 2 volts representing white. This signal drives the intensity circuit for the electron beam. In a black-and-white TV, this signal can consume about 3.5 megahertz (MHz) of bandwidth, while in a color set the limit is about 3.0 MHz.

A vertical-retrace pulse is similar to a horizontal-retrace pulse but is 400 to 500 microseconds long. The vertical-retrace pulse is serrated with horizontal-retrace pulses in order to keep the horizontal-retrace circuit in the TV synchronized.

Composite video (1 channel) is an analog video transmission (no audio) that carries standard definition video typically at 480i or 576i resolution. Video information is encoded on one channel, unlike the slightly higher quality S-video (2 channel) and the even higher quality component video (3 or more channels).

Composite video is usually in standard formats such as NTSC, PAL, and SECAM and is often designated by the CVBS initialize, for color, video, blanking, and sync, or simply as video.

A composite video signal combines on one wire the video information required to recreate a color picture, as well as line and frame synchronization pulses. The color video signal is a linear combination of the luminance of the picture, and a modulated subcarrier carries the chrominance or color information, a combination of hue and saturation. Details of the encoding process vary between the NTSC, PAL and SECAM systems.

The frequency spectrum of the modulated color signal overlaps that of the baseband signal, and separation relies on the fact that frequency components of the baseband signal tend to be near harmonics of the horizontal scanning rate, while the color carrier is selected to be an odd multiple of half the horizontal scanning rate; this produces a modulated color signal that consists mainly of harmonic frequencies that fall between the harmonics in the baseband luma signal, rather than both being in separate continuous frequency bands alongside each other in the frequency domain. In other words, the combination of luma and Chroma is indeed a frequency-division technique, but it is much more complex than typical frequency division multiplexing systems like the one used to multiplex analog radio stations on both the AM and FM bands.

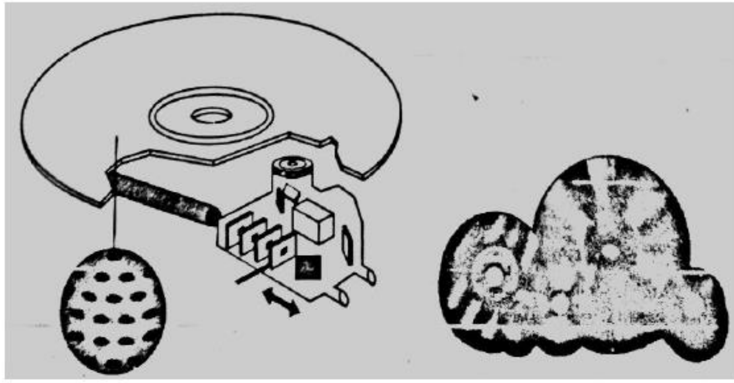
Color burst is a composite analog video signal generated by a video-signal generator used to gen lock, keep the chrominance subcarrier synchronized in television studios for color television.

1. NTSC
2. PAL
3. SECAM

16. Explain in detail about the CD player and compare with DVD player. (MODEL)

In the Laser Vision System, Figure3.1 (a), which records video information, the signal is recorded on the disc in the form of a spiral track that consists of a succession of pits. The intervals between the pits are known as lands. The information is present in the track in analog form. Each transition from land to pit and vice versa marks a zero crossing of the modulated video signal. On the t compact disc, Figure.3.1 (b), the signal is recorded in a similar manner, but the information is present in the track in digital form. Each pit and each land represents a series of bits called channel hits. After each land/pit or pit/land transition there is a 1, and all the channel bits in between are 0, (see Figure.3.2).

The density of the information on the compact disc is very high; the smallest unit of audio information (the audio hit) covers an area of 1 pm2 on the disc, and the diameter of the scanning light spot is only 1 pm. The pitch of the track is 1.6 pm, the width 0.6 pm and the depth 0.12 pm. The minimum length of a pit or the land between two pits is 0.9 pm; the maximum length is 3.3 pm. The side of the transparent carrier material



(a) (b)

Figure.3.1 (a) Details of laser vision system showing the optical pickup and the disc microstructure and (b) Compact discs

T in which the pits are impressed, the upper side during playback if the spindle is vertical, is covered with a *reflecting layer R* and a *protective layer* P. *The track is optically scanned from below the disc at a constant velocity of 1.25 m/s.* The *speed of rotation* of 35 the disc therefore varies from about 8 rev/s to about 3.5 revs (or 480 rpm to about 210 rpm).

17. Illustrare the different types of cellular mobile communication systems in details.

CELLULAR MOBILE COMMUNICATION SYSTEMS

- When an existing system undergoes a unique improvement, it is wise to give that system a new name. This is what happened with the mobile two-way telephone communications system.
- Under the original plan, a single medium-power transmitter was placed at the centre of population in an urban community having a service area of about 50 miles in diameter. The central transceiver had a capacity of between 100 and 500 channels however, because mobile telephones are full-duplex, the system was limited to about 250 conversations at a time.
- Although the costs were high and subscriber lists were small, the system served the community very well. As the community and the subscriber lists grew, users experienced long waiting periods before they could get into the system.
- Most of the systems were owned and operated by the local telephone companies, which were capable of supplying mobile-to-mobile as well as mobile-to-home or mobile-to-business telephone interconnections.
- The geographical shape of the service area was controlled by the radiation pattern of the transmitting antenna, but problems resulted when the community grew or changed shape.

- The changes to this system had to be planned and implemented over a period of time. The first step was to use new system-ready mobile units in new installations, which offered capabilities far beyond those of the old system.
- Once the mobile units were in place, the second step was to convert the large service area into several smaller service areas, called cells. The cells took on the hexagonal shape of a honeycomb.
- The one high-power transmitter was replaced by six separate 5 W transceivers tied together by land line interconnections through the branch exchanges of the telephone companies.

A mobile unit in cell C, A would transmit to cell transceiver, then through the telephone system to cell where the message would be retransmitted to a mobile unit in cell C's area. These two steps introduced several advantages. First, the cell transmitter and mobile transmitter each operate at a lower power. Second, a mobile unit in cell A, one in cell C, and a third in cell F could use the same frequencies without channel interference. The reuse of frequencies will increase the system's capacity by as many cells as can use the same frequencies. The only restriction is that adjacent cells may not use the same frequencies. Third, the system is easily expanded because adding a new cell will not affect any of the established cells. Fourth, cells provide better management of the total service area

- These are the most obvious differences. Each cell's transceiver is connected through the telephone system to a central mobile switching office MSO for better overall system control.
- The cells are not independent of each other, or of the total system. Suppose a mobile unit in cell A is using channel 24, and another unit in cell C is also using channel 24.
- So far, no problem since the same frequencies may be used in widely separated cells. Suppose unit -A, being mobile, now moves into cell B as in **Fig.**11.
- The MSO keeps track of which frequencies are in use in each cell, knowing that adjacent cells should not use the same frequency.
- As soon as cell A gives up control of unit A to cell B, the MSO will change the transmit/receive frequencies of either mobile unit depending on the number of channels in use of each cell.
- The communications link will thus continue on without co-channel interference. The switchover takes about 250ms and will generally go unnoticed by either mobile unit operator.

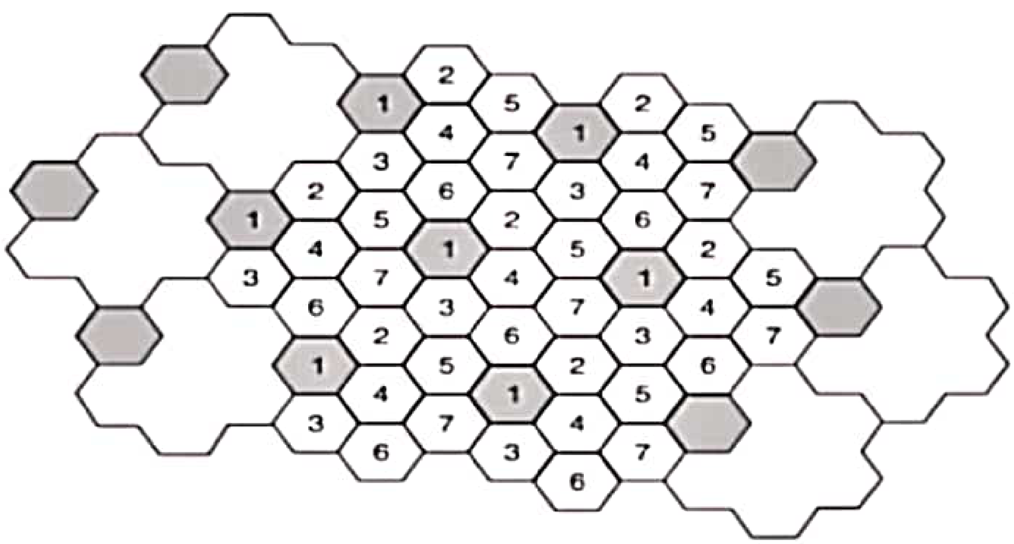


Fig.11. Cellular mobile telephone system.

- A cellular mobile telephone system divides the area to be served into hexagonal zones or cells. Each cell uses a different set of frequencies to its immediate neighbors. The cells are grouped into blocks in this illustration, blocks of seven cells.
- The pattern of frequencies is repeated in each block. Thus the tone-filled cells in this illustration use identical frequencies. There could be more cells in a block than illustrated here.

A step-by-step trip through a complete transaction will clarify other differences from the original mobile telephone systems. To begin, each cell transceiver sends out an identification signal of equal strength for all cells. When a mobile unit operator picks up the handset, a scanning system in the unit measures the signal strength of all cells' identification code signals.

The mobile unit then sets up contact with the cell having the strongest signal. The data channel in each cell transceiver, called a setup channel operates at a 300 band and uses the ASCII 7-bit code. The mobile unit also sends the cell its identification code, which is then passed on to the MSO by telephone line for recognition, frequency assignment, and future billing. The mobile operator then gets a dial tone and initials a call in the usual manner. The call transaction is the same as any standard telephone call.

During the time of the call, the cell transceiver monitors all of the active channels in its area as well as in the six surrounding cell areas. It maintains a constant conversation with its six adjacent cells and the MSO.

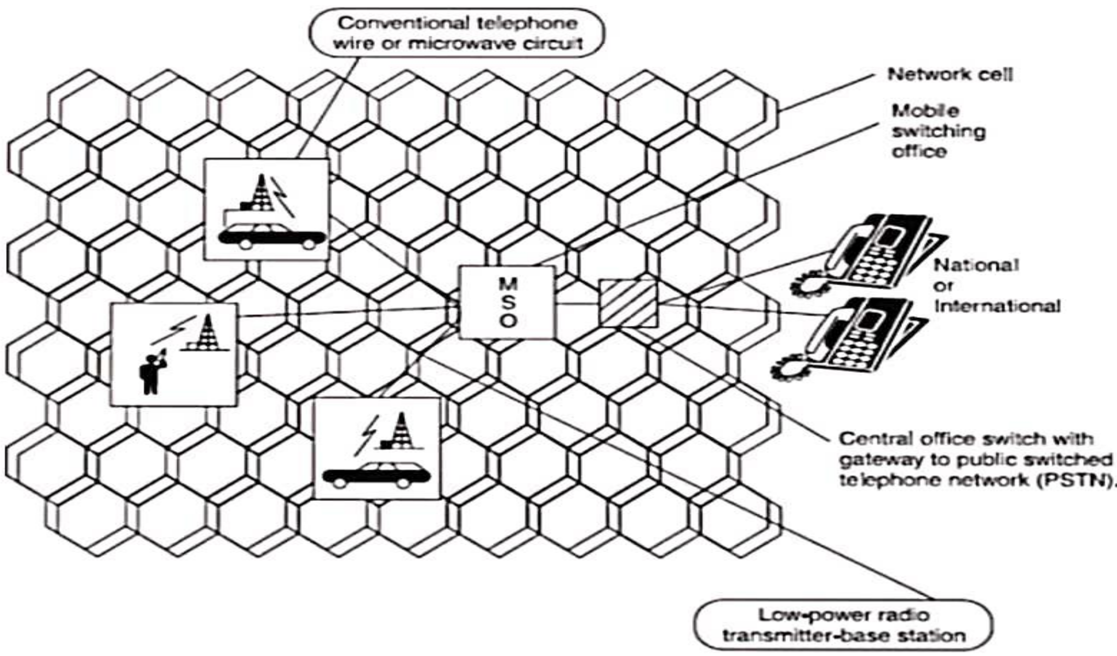


Fig.12. Cellular Network

Together, they control which mobile unit is on what channel, which cell is the controlling cell (by comparing the strength of the mobile signal in each area), the location of a mobile unit in each cell, and what action is to be taken when a mobile moves from one cell to another.

The controlling cell uses a form of reverse AGC; that is, it can order the mobile unit to alter its output so that cell interference is minimized. The mobile output power is maximum at 3W, but it can be reduced in 1 dB steps (seven steps total) to as little as 0.6 W. All of these control functions are carried on without the phone operator's knowledge. The cellular radio network is elaborated in **Fig.**12.

- In a cellular radio network each cell contains a base station that is connected to a mobile switching office by a leased terrestrial or microwave circuit. Each base station sends and receives signals from mobile units located in their cell.
- The MSO handles channel allocation and call switching, and provides a gateway to the public switched telephone network, thus allowing calls to be switched between the two networks.
- Because only adjacent cells use different frequencies, a large number of users can be accommodated by a cellular network even though only a limited frequency bandwidth is used.

18. Explain WIFI and Bluetooth in details.

WiFi

4. **Resolution**: Standard resolution is 203 lines per inch across and 98 lines per inch down the page. Fine resolution requires twice the number of lines (196 lines per inch) down the page. Most group 3 fax machines include a high resolution option.

- Wi-Fi is the name of a popular wireless networking technology that uses radio waves to provide wireless high-speed Internet and network connections.
- A common misconception is that the term Wi-Fi is short for "wireless fidelity," however this is not the case. Wi-Fi is simply a trademarked phrase that means IEEE 802.11x.

The Wi-Fi Alliance

- The Wi-Fi Alliance, the organization that owns the Wi-Fi registered trademark term specifically defines Wi-Fi as any "wireless local area network (WLAN) products that are based on the Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards."
- Initially, Wi-Fi was used in place of only the 2.4GHz 802.11b standard, however the Wi-Fi Alliance has expanded the generic use of the Wi-Fi term to include any type of network or WLAN product based on any of the 802.11 standards, including 802.11b, 802.11a, dual-band, and so on, in an attempt to stop confusion about wireless LAN interoperability.

Wi-Fi Working Principle

- Wi-Fi works with no physical wired connection between sender and receiver by using radio frequency (RF) technology, a frequency within the electromagnetic spectrum associated with radio wave propagation.
- When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space.
- The cornerstone of any wireless network is an access point (AP). The primary job of an access point is to broadcast a wireless signal that computers can detect and "tune" into. In order to connect to an access point and join a wireless network, computers and devices must be equipped with wireless network adapters.

WiFi

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Working of WiFi

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- When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space.
- The cornerstone of any wireless network is an access point (AP). The primary job of an access point is to broadcast a wireless signal that computers can detect and "tune" into.

- In order to connect to an access point and join a wireless network, computers and devices must be equipped with wireless network.

Wi-Fi Support

- Wi-Fi is supported by many applications and devices including video game consoles, home networks, PDAs, mobile phones, major operating systems, and other types of consumer electronics.
- Any products that are tested and approved as "Wi-Fi Certified" (a registered trademark) by the Wi-Fi Alliance are certified as interoperable with each other, even if they are from different manufacturers. For example, a user with a Wi-Fi Certified product can use any brand of access point with any other brand of client hardware that also is also "Wi-Fi Certified".
- Products that pass this certification are required to carry an identifying seal on their packaging that states "Wi-Fi Certified" and indicates the radio frequency band used (2.5GHz for 802.11b, 802.11g, or 802.11n, and 5GHz for 802.11a).

BLUETHOOTH

Compared to the WLAN technologies presented in sections 7.3 and 7.4, the Bluetooth technology discussed here aims at so-called ad-hoc Pico nets, which are local area networks with a very limited coverage and without the need for an infrastructure. This is a different type of network is needed to connect different small devices in close proximity (about 10 m) without expensive wiring or the need for a wireless infrastructure

User scenarios

Many different user scenarios can be imagined for wireless Pico nets or WPANs:

- Connection of peripheral devices: Today, most devices are connected to a desktop computer via wires (e.g., keyboard, mouse, joystick, headset, speakers).
- This type of connection has several disadvantages: each device has its own type of cable, different plugs are needed, and wires block office space. In a wireless network, no wires are needed for data transmission.
- However, batteries now have to replace the power supply, as the wires not only transfer data but also supply the peripheral devices with power.
- Support of ad-hoc networking: Imagine several people coming together, discussing issues, exchanging data (schedules, sales Fig. etc.).
- For instance, students might join a lecture, with the teacher distributing data to their personal digital assistants (PDAs). Wireless networks can support this type of interaction; small devices might not have WLAN adapters following the IEEE 802.11 standard, but cheaper Bluetooth chips built in.

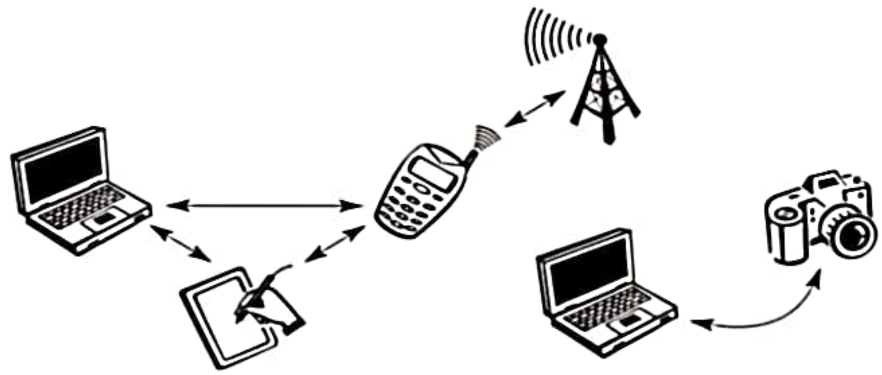

Fig.22. Bluetooth con Figurations

Example con Figurations with a Bluetooth-based Pico nets

- Bridging of networks: Using wireless Pico nets, a mobile phone can be connected to a PDA or laptop in a simple way. Mobile phones will not have full WLAN adapters built in, but could have a Bluetooth chip.
- The mobile phone can then act as a bridge between the local Pico nets and, e.g., the global GSM network as in **Fig**. 22.
- For instance, on arrival at an airport, a person's mobile phone could receive e-mail via GSM and forward it to the laptop which is still in a suitcase. Via a Pico nets, a fileserver could update local information stored on a laptop or PDA while the person is walking into the office.
- Architecture like IEEE 802.11b, Bluetooth operates in the 2.4 GHz ISM band. However, MAC, physical layer and the offered services are completely different. After presenting the overall architecture of Bluetooth and its specialty, the Pico nets, the following sections explain all protocol layers and components in more detail.

Networking

- To understand the networking of Bluetooth devices a quick introduction to its key features is necessary. Bluetooth operates on 79 channels in the 2.4 GHz band with 1 MHz carrier spacing.
- Each device performs frequency hopping with 1,600hops/s in a pseudo random fashion. Bluetooth applies FHSS for interference mitigation (and FH-CDMA for separation of networks).
- A very important term in the context of Bluetooth is a Pico nets. A Pico nets is a collection of Bluetooth devices which are synchronized to the same hopping sequence. **Fig**. 23, shows a collection of devices with different roles.
- One device in the Pico nets can act as master (M), all other devices connected to the master must act as slaves (S).
- The master determines the hopping pattern in the Pico nets and the slaves have to synchronize to this pattern.
- Each Pico nets has a unique hopping pattern. If a device wants to participate it has to synchronize to this.

19. Elaborate the principle and working of an Air conditioning in detail with diagrams.(MODEL)

3. AIR CONDITIONING:

Air conditioning is the process of treating air in an internal environment to establish and maintain required standards of temperature, humidity, cleanliness, and motion. This is how each of these conditions is controlled:

1. Temperature: Air temperature is controlled by heating or cooling the air. Cooling technically means the removal of heat, in contrast to heating, the addition of heat.
2. Humidity: Air humidity, the water vapour content of the air, is controlled by adding (humidification) or removing (dehumidification) water vapour from the air.
3. Cleanliness: Air cleanliness or air quality is controlled by either filtration, the removal of undesirable contaminants using filters or other devices or by ventilation, the introduction of outside air into the space which dilutes the concentration of contaminants. Often both filtration and ventilation are used in an installation.
4. Motion: Air motion refers to air velocity and to where the air is distributed. It is controlled by appropriate air distributing equipment.

Sound control can be considered an auxiliary function of an air conditioning system even though the system itself may be the cause of the problem. The air conditioning equipment may produce excessive noise requiring additional sound attenuating (reducing) devices as part of the equipment. The above description does not imply that every HVAC (heating, ventilation and air conditioning) system regulates all of the conditions described. A hot water or steam heating system consisting of a boiler, piping, and radiation devices (and perhaps a pump) only controls air temperature and only during the heating season. These types of systems are common in many individual homes (residences), apartment houses, and industrial buildings.

A warm air system, consisting of a furnace, ducts, and air outlet registers, also controls air temperature in winter only. However, by the addition of a humidifier in the ducts, it may also control humidity in winter. Warm air systems are popular in residences. Some residences have combination of air heating and air cooling equipment that provides control of temperature and humidity in both winter and summer. Some degree of control of air quality and motion is provided in air-type heating and cooling systems.

Air conditioning systems used for newer commercial and institutional buildings and luxury apartment houses usually provide year round control of most or all of the air conditions described. For this reason, it is becoming increasingly popular to call complete HVAC systems environmental control systems. Most air conditioning systems are used for either human comfort or for process control. Air conditioning enhances our comfort. Certain ranges of air temperature, humidity, cleanliness, and motion are comfortable; others are not. Air conditioning is also used to provide conditions that some processes require. For example, textile printing, and photographic processing facilities as well as computer rooms and medical facilities, require certain air temperature and humidity for successful operation.

Components of air conditioning systems

Heat always travels from a warmer to a cooler area. In winter, there is a continual heat loss from within a building to the outdoors. If the air in the building is to be maintained at a comfortable temperature, heat must be continually supplied to the air in the rooms. The equipment that furnishes the heat required is called a heating system. In summer heat continually enters the building from the outside. In order to maintain the room air at a comfortable temperature, this excess heat must be continually removed from the room. The equipment that removes the excess heat is called a cooling system.

An air conditioning system may provide heating, cooling, or both. Its size and complexity may range from a single space heater or window unit for a small room to a huge system for a building complex. Most heating and cooling systems must have the following basic components:

1. A heating source that adds heat to a fluid (air, water, or steam).
2. A cooling source that removes heat from a fluid (air or water).
3. A distribution system (a network of ducts or piping) to carry the fluid to the rooms to be heated or cooled.
4. Equipment (fans or pumps) for moving the air or water.
5. Devices (e.g., radiation) for transferring heat between the fluid and the room.

All-water air conditioning systems:

A typical hydronic (all water) heating system is shown in below Fig. Water is heated at the heat source (1) usually a hot water boiler. The heated water is circulated by a pump (2) and travels to each room through piping (3) and enters a terminal unit (4). The room air is heated by bringing it into contact with the terminal unit. Since the water loses some of its heat to the rooms, it must return to the heat source to be reheated.

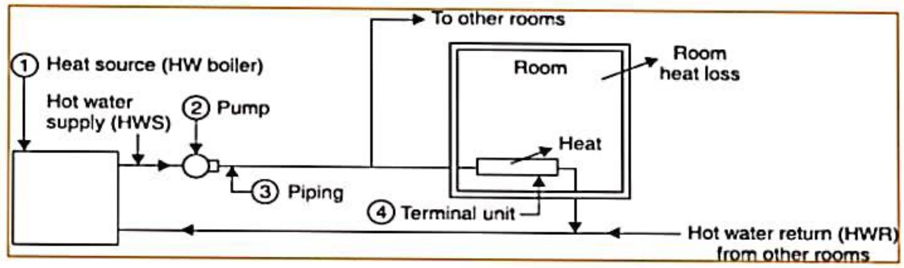

Fig. Arrangement of basic components of a (hydronic) hot water heating system

If steam is used in a heating system, the components still work in the same manner, with the exception that a pump is not necessary to move the steam; the pressure of steam accomplishes this. However, when the steam cools at the terminal unit, it condenses into water and may require a condensate pump to return the water to the boiler. A hydronic cooling system Fig functions in a similar manner to the hydronic heating system. Water is cooled in refrigeration equipment called a water chiller (1). The chilled water is circulated by a pump (2) and travels to each room through piping (3) and enters a terminal unit (4).

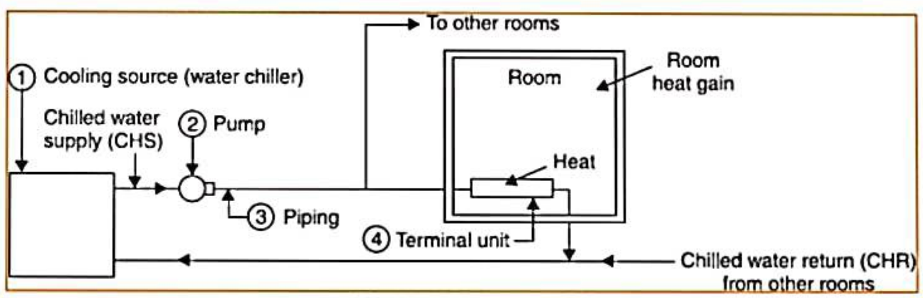

Fig. 52.2 Arrangement of basic components of (hydronic) chilled water cooling system

Hydronic systems are popular for HVAC systems that require both heating and cooling. This is because it is possible to use the same piping system for both by connecting a hot water boiler and water chiller in parallel, Fig. 52.3, using each when needed.

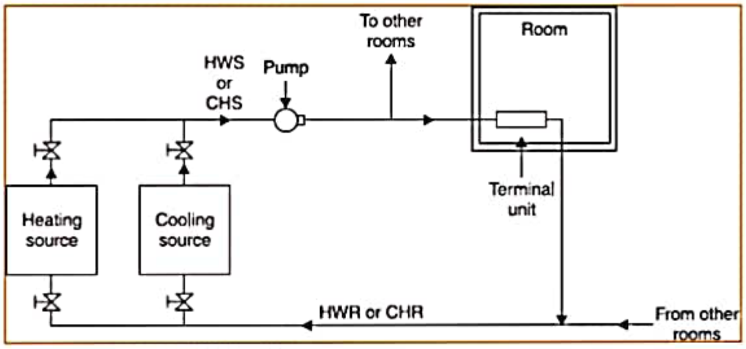

Fig. Arrangement of basic components of a hydronic heating and cooling system

All-air air conditioning systems

All-air systems use air to heat or cool rooms. They may also have the added capability of controlling humidity and furnishing outdoor ventilation, which hydronic systems cannot do. A typical all-air heating and cooling system is shown in Fig. Air is heated at the heat source (1), such as a furnace. It may also be a coil circulating hot water, or steam, heated by a boiler. The heated air is circulated by a fan (2) and travels to each room through supply air ducts (3). The supply air enters the room through outlets called air diffusers or registers (4) that are designed to provide proper air distribution in the room. When the warmed supply air enters the room, the room is heated. A humidifier (10) may also be included to maintain comfortable room humidity in winter.

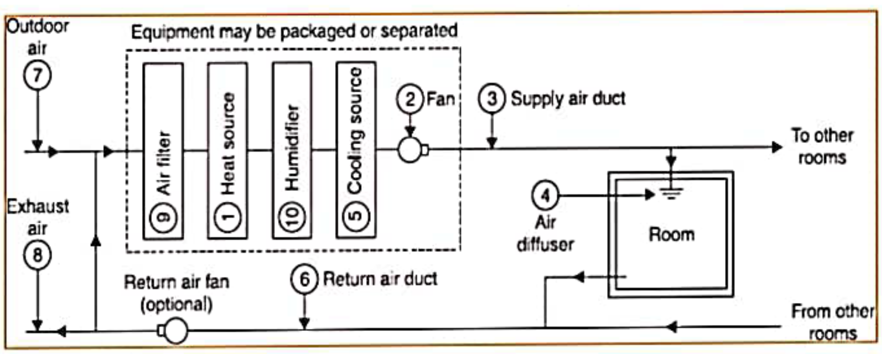

Fig. Arrangement of basic components of an all-air heating and cooling system

In summer, air is cooled when it flows over a cooling source (5), usually a coil of tubing containing a fluid cooled by refrigeration equipments. When the cooled supply air enters the

20. Explain with neat diagram the principle and working of the washing machine and also state its commercial use.

4. Retains most of the nutrients.
5. Enhances the colour and texture of food.
6. System can be combined with a conventional heating process.

2. WASHING MACHINE :

A washing machine (laundry machine, clothes washer, or washer) is a machine used to wash laundry, such as clothing and sheets. The term is mostly applied to machines that use water as opposed to dry cleaning (which uses alternative cleaning fluids, and is performed by specialist businesses) or ultrasonic cleaners. Laundry detergent is frequently used to clean clothes, and is sold in either powdered or liquid form.

Electronic controller for washing machines

The task here is simply to identify the input and output devices used in electronic washing machines and to construct a block diagram showing their connections to the controller. Detailed information about the characteristics of sensors and actuators can be added at a later stage.

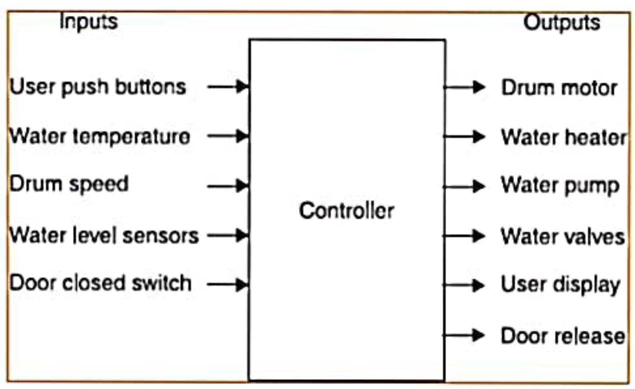

Fig. Inputs and outputs in an electronic washing machine

There are many acceptable ways of representing the system. It would, for example, be possible to consider the display to be internal to the controller and therefore not show it separately. Similarly clock circuitry used to time the operation of the machine is considered here to be contained within the controller. It could equally well be considered as an external component. The block diagram is a good starting point for the generation of the specification since it shows very clearly the structure of the complete system. The block diagram makes no assumptions of the form of the controller.

It could be implemented using an electromechanical timer, or a microcomputer, or a range of other technologies. Many modern washing machines now use microcomputer to control their various functions, replacing the electromechanical controllers used in earlier models. Clearly it is not practical to consider all aspects of such a system, but it is instructive to look at some elements of the design. At various stages of the washing cycle the drum is required to rotate at different speeds. These include: a low speed of about 30 revolutions per minute (rpm) while clothes are washed: an intermediate speed of about 90 rpm while the water is pumped out and a high speed of either 500 or 1000 rpm to spin dry the clothes. Let's consider how the microcomputer should control the speed of the motor. Since a domestic washing machine is a very high-volume product, the design should attempt to minimize the amount of hardware required. This necessitates a close look at the choice of sensors and actuators to select low-cost items. Our first decision must be whether the system will be open loop or closed loop. Since although an open-loop system is theoretically possible using a synchronous motor the cost of such a system for high-power variable-speed applications is prohibitive. The system will therefore be closed loop using a motor to drive the drum and some form of sensor to measure its speed.

One of the simplest methods of speed measurement is to use a counting technique illustrated in Fig. It uses a fixed inductive sensor to produce a pulse each time it is passed by a magnet which rotates with the drum. This produces one pulse per revolution of the drum which can be used to determine its speed. The speed of the motor will be controlled by the power dissipated in it. The simplest way of speed control is to use a triac. The power could be controlled by some form of electronic circuitry, but the hardware requirement can be reduced if the microcomputer controls the power directly by firing the triac at an appropriate time during its cycle. To do this the controller must detect the zero crossing of the ac supply. This will require circuitry to detect the crossing point while protecting the processor from high voltages. A block diagram of the system is shown in Fig. At any time in the washing cycle the program determines at what speed the drum should rotate. From knowledge of the required speed and the actual speed as obtained above, the controller can determine whether to increase or decrease the power dissipated in the motor.

The motor power is determined by the timing of the triac firing pulse. If the triac is fired at the beginning of each half of mains cycle it will remain on for the remainder of the half cycle and the motor will operate at full power. The longer the processor waits before firing the triac, the less will be the motor power. The processor thus varies the delay time with respect to the zero crossing point of the mains by an appropriate amount to increase or decrease the power in the motor as determined by the difference between the actual and required speeds.

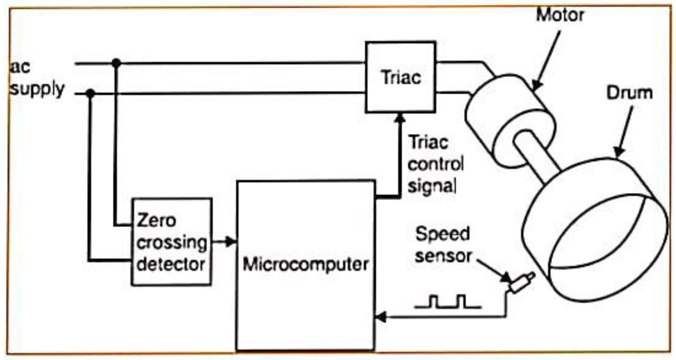

Fig. Washing machine control

This method of controlling the motor speed is very processor intensive. It consumes a large amount of processor time and will require a considerable amount of effort in writing and developing the software. However, this approach uses very little hardware and is thus very attractive for such a high-volume application.

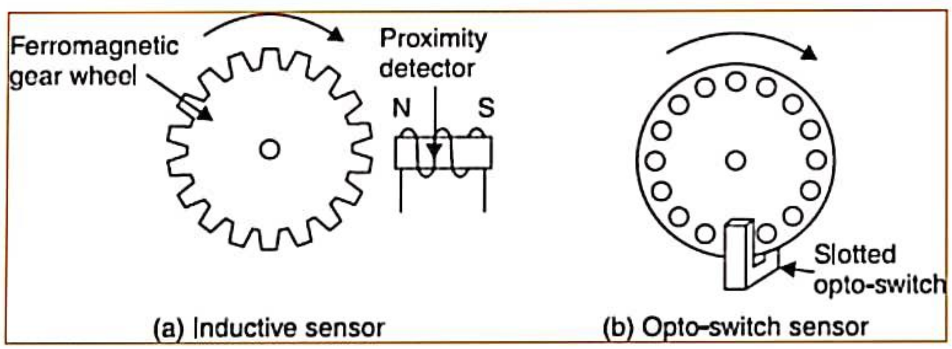

Fig. Displacement sensors using counting

Washing machine hardware

A system is an assembly of components united by some form of regulated interaction to form an organized whole. We will examine a microcomputer system, using a washing machine control as an example. The input peripherals consist of

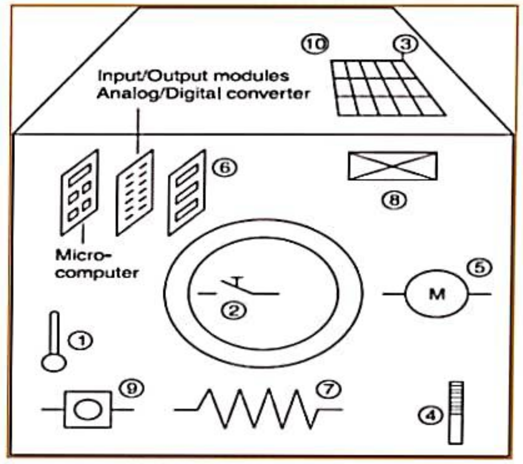

Fig. Washing machine—hardware

1. Temperature sensor which senses the washing water temperature. (The analog/digital converter changes the analog values to binary numbers).
2. Safety cut-out switch.
3. Keyboard for program selection.
4. Water level gauge.
5. Motor for washing drum.
6. Power switches for motor, heater, etc.
7. Heater for washing water.
8. Water inlet valve.
9. Water suction pump.
10. Control lamps and indicators.

The units listed above i.e. the washing machine as well as its mechanical components, electrical units and electronic components are known as hardware.

Hardware and software development:

We will now examine how a system is developed. The example used for this is, of course, a simple washing machine control. The development will follow the broad pattern shown in Fig.

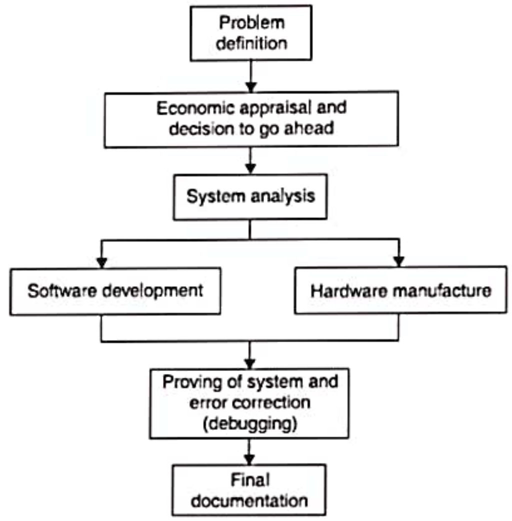

Fig. Developing the system for washing machine control

The problem definition is based on the requirements of the specification. It is also necessary for the redesign of the existing unit. It is a means of determining what a system's performance is capable of and what is required from it. Data flow charts are used to identify all the hardware elements of a system at this stage for a general broad picture of the structure of the installation. Program flow charts permit the costs of the necessary software to be established in the development stage and represent useful aids for the designer. The decision to go ahead with the developments of a system is governed by economic appraisal and technical feasibility of the plan. To establish these criteria the required operating speed, memory storage capacity and costs of the component parts of the system must be determined. Subsequently the structure of the problem is analyses and the final production costs deduced. There are two alternative approaches for hardware development. On one hand, a universal system may be considered which has not been designed to cope with any one specific problem. On the other hand a specially designed system may be decided upon in which the components used are specially selected for their suitability to deal with the problem under consideration. Such optimization is generally not possible when standard systems are employed. For software development a detailed program sequence plan must first be established. This is then written in the appropriate code and fed into a computer or into a development system. The program is then translated into the language required by the machine and a simulation of the operation sequence is carried out. Any errors found in the program are corrected (this is known as debugging) and the software is then available for use.