

4th module

Video recording and play back

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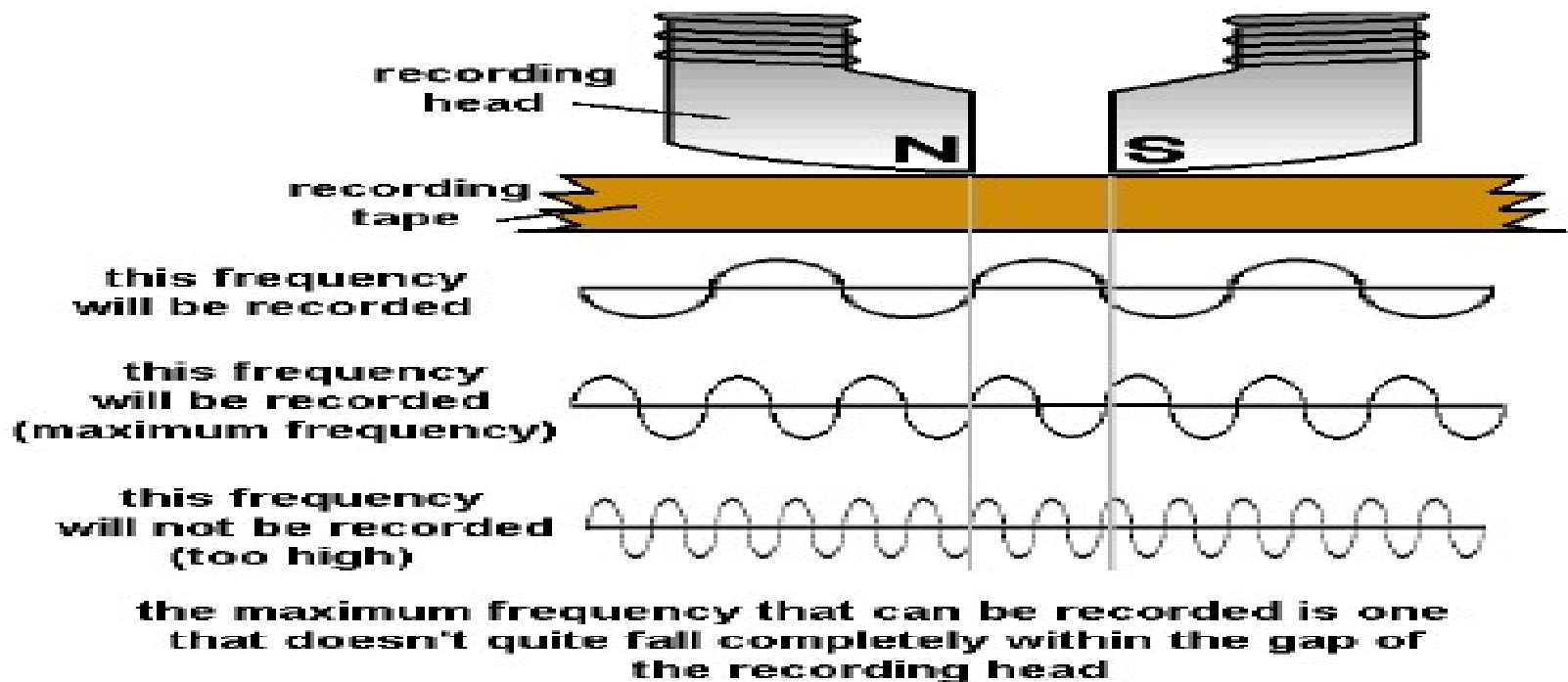
- Introduction:
- Filmonly medium available for recording television pgms
- Magnetic tape....used for sound
- The greater the quantity of information carried by television signal demanded new studies

- 1920 American Engineer ,Philo Taylor Farnsworth devised the television camera , an image dissector ,which converted the image captured in to an electrical signal
- The pick-up tube is the main element governing the technical quality of the picture obtained by television camera
- The first electronic cameras using iconoscope tubes were characterized by very large lenses ,necessary to ensure enough light reached the pick-up tube

- **Charles Ginsburg** led Ampex research team developing one of the first practical video tape recorder(VTR).
- In 1951 the first video tape recorder captured live images from television cameras by converting the camera's electrical pulses and saving the information on to magnetic video tape
- Video technology was first developed for CRT television systems.
- VTR is 1st practical video tape recorder
- VCR can do same
- In 1980 and 1990 VCR removed by DVD players

4.1 basics of analog video tape recording principles

- 4.1.1 Relationship of Tape and Bandwidth



4.2 Recording on magnetics tape and Reproduction

Several inventions

1) In November 1951: The electronics division of Bing Crosby Enterprises,

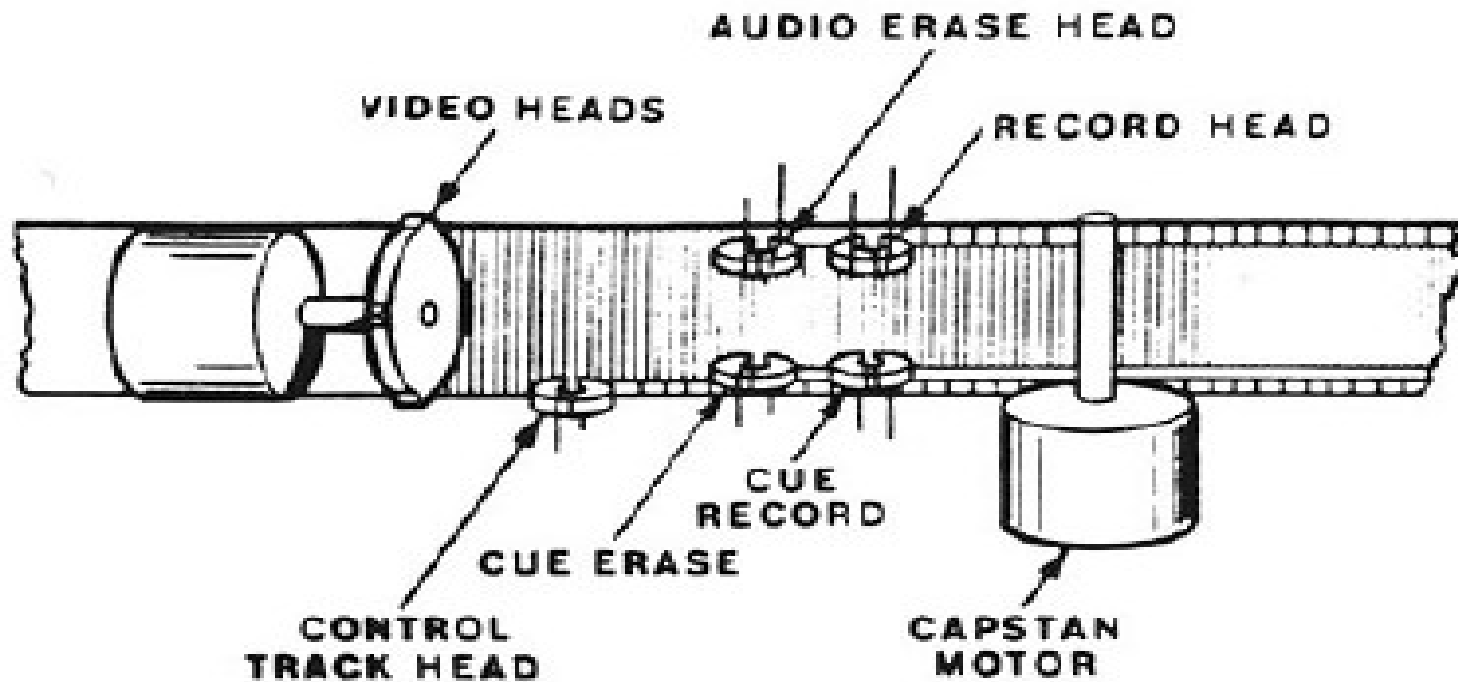
→ put on display a videotape recorder which produced black and white images

→ Had 12 fixed recording heads.

- In this recorder high speed head switching was employed along with 1" tape and 100 inches per second tape speed.

->It made 1.7 MHz recording on reels that could hold 16 minutes of programme material which would have been done on 8000 feet of tape

System created by Ampex; track layout on a 2" quadruplex videotape machine



2) Vision Electronic Recording Apparatus(VERA) was shown to the world by BBC in 1952

- It made use of two video tracks and has tape speeds of 200 inches per second and resolution was extremely low

3) Radio Corporation of America's (RCA) black and white systems was on display in December of 1953

- It has a single one continuous video track, with a 17" reel of ¼" wide tape, moving at 360 inches per second
- It was proved by RCA a few days on that they were in a capacity to accomplish the same in color
- They name use of a 17" reel of wide tape with three video tracks(R, G, B) and a sync pulse track, still running at 360 inches per second and a recording time of 4 minutes.

4) In 1956 the actual success was achieved by the breakthrough made by an Ampex engineering team

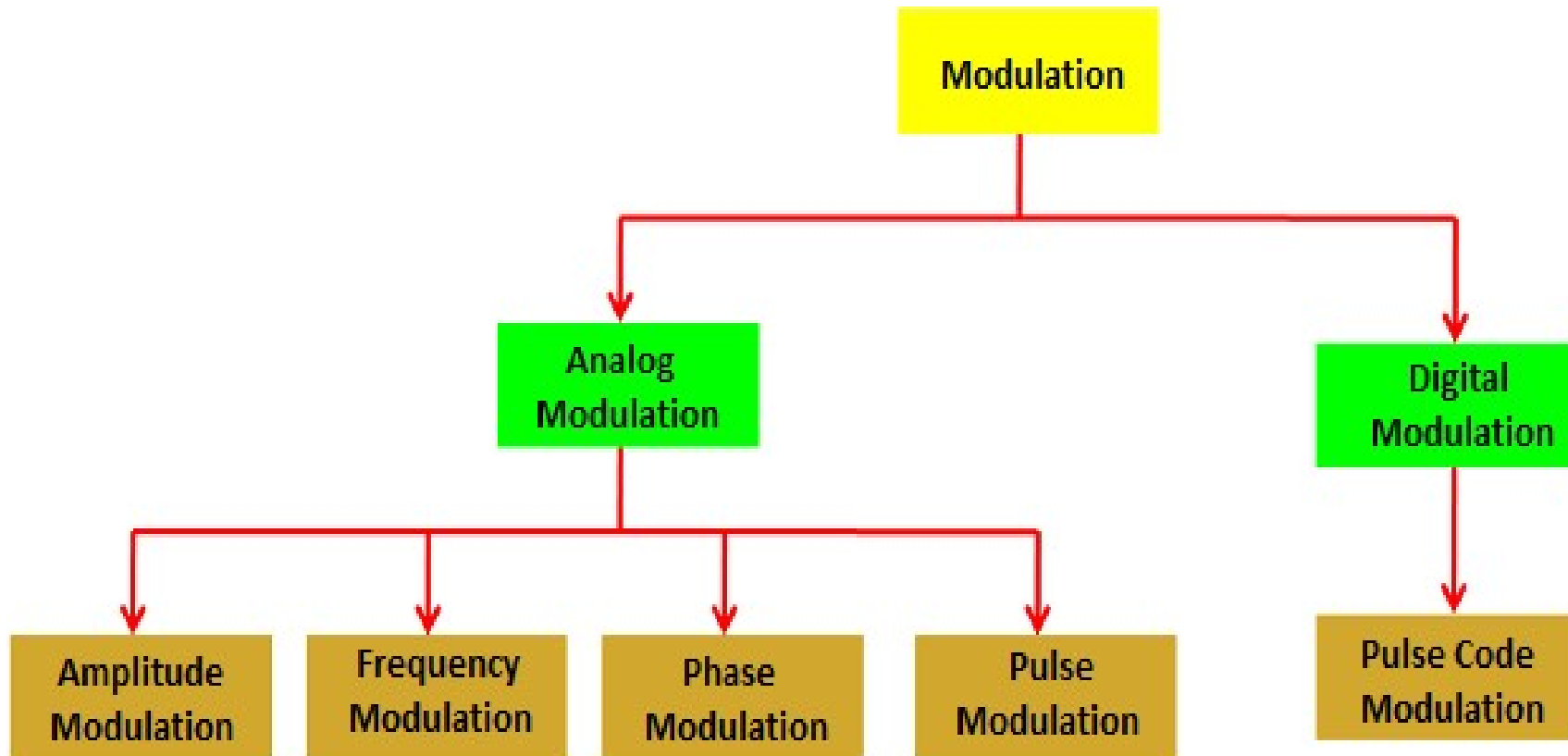
- Their solution was to use a drum to mount the recording heads which revolved at high speed of 14,400 rpm and impressed the signal on the tape crosswise
- While actual head to tape speed was extremely high ,the tape was moved by the tape transport at a speed which was relatively slow
- This was the “quad” and it was called this due to the fact that it employed four heads for recording
- The tape used in this system was 2” wide
- (figure study from text book)

- The head drum ,in a single second rotated 240 times and placed 960 short tracks on the videotape.
- With a 2 “ wide tape ,there is still room for audio ,control track, and blank ,separating ‘guard bands’ between all of the tracks
- So Every video track will be approximately $1 \frac{4}{5}$ inches long.
- To ensure that there is uninterrupted output from switched heads, just about $1 \frac{5}{8}$ inches is made use of for fresh video – the remainder holds an overlap from the video of the previous track

2" inch quadruplex video tape compared with mini dvd

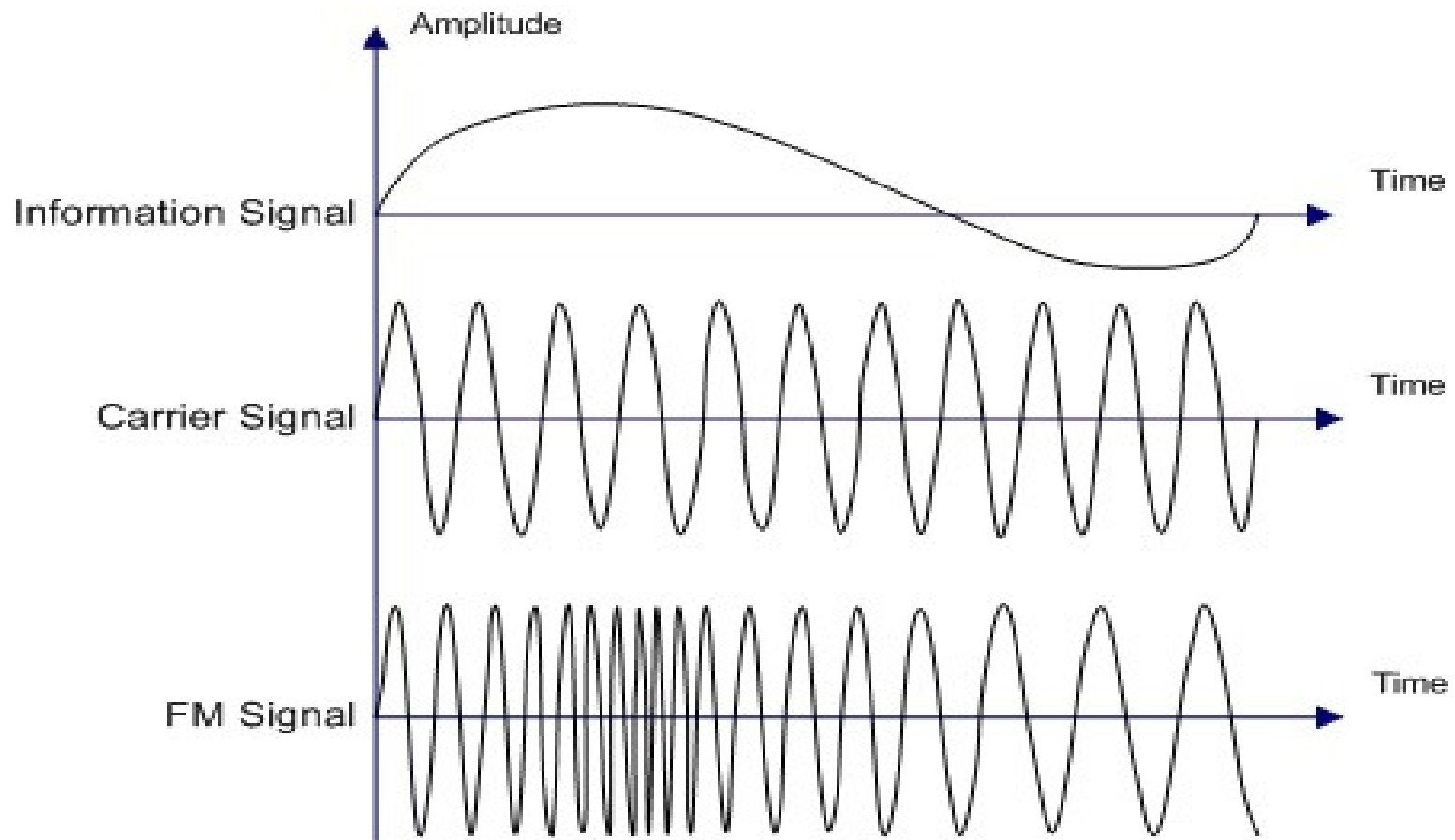


- In case of Ampex system ,the effective tape-to –head speed was 1560 inches per second
- $960 \text{ tracks per second} * 1.625 \text{ inches} = 1560 \text{ i.p.s}$
- The applied frequency will be till 13 MHz ...its enough for video signal
- The frequency of recorded signal goes higher and higher ,the greater is the playback output from the tape
- Record on video tape signals anywhere from 30 Hz to 42,00000 Hz,a ratio of 1,40000:1
- Due to this playback voltage at 30 Hz will be $1/ 140000$
- Its possible to employ a super equalizer to hold down the higher frequencies to make them even with each other ,but generally equalizers and amplifiers will have some electronic noise when lower than 60dB
- With modulator the noise can be handled



Types of modulation

- FM and AM
- A carrier of 8.6 MHz gets modulated via the incoming video (4.2 MHz)
- The variation on the modulator output can be between 4.4 MHz to 12.8 MHz
- $8.6 - 4.2 = 4.4$
- $8.6 + 4.4 = 12.8$



- Study diagrams from text book
- For applying such a modulated system, it should be possible to record up to 13 MHz of information on the VTR.
- A quad system that has the 1560 inches effective tape to head speed, that recording capacity can be obtained

Demodulation

- A demodulator performs the task of getting the video signal from the tape
- In other words, a demodulator picks high frequency signal from the tape and from it extracts the video signal
- This extracted video signal is sent through several processes so that it becomes stable and its levels get adjusted ,so that it becomes just like a video from other video sources

Servos and Time Base Correctors

Keeping track of the tracks

- During the process of recording on video tape , it is essential that track be kept of what is recorded where and have a system of letting the video tape learn this information when needed for playback.
- Additionally, with the help of servo ,the head drum motor and the capstan motor kept running at a constant ,identifiable speed ,which is referenced to the incoming video.

- **Drum and capstan servos**

We can consider servo as being a control mechanism which runs automatically and compares the output of a device with a stable input reference , for the purpose of making required corrections

Drum Servo

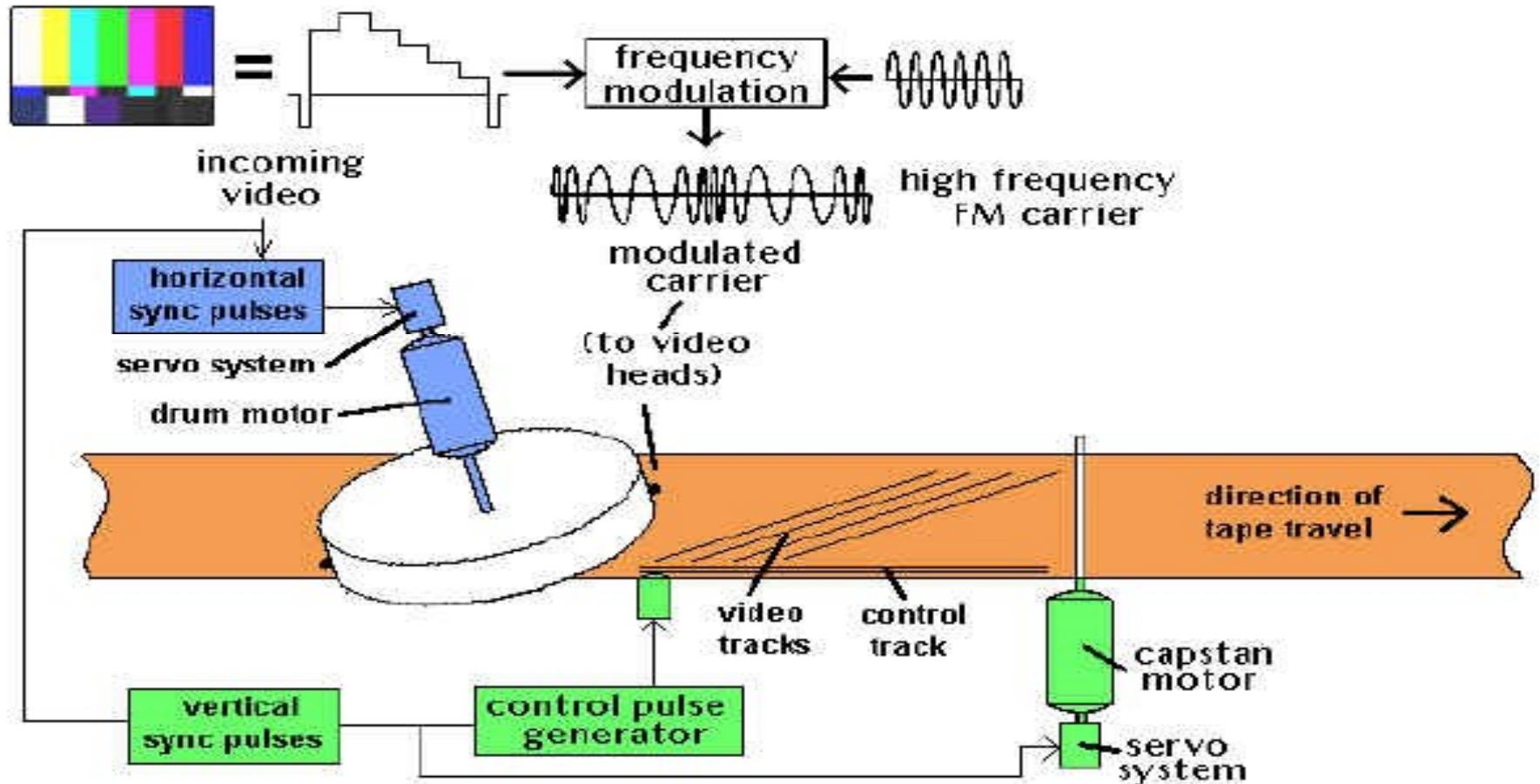
- With the help of drum servo it becomes possible to ensure that as the video heads move across the videotape they maintain a steady speed.
- At the time of recording, the drum servo uses the incoming video's horizontal sync pulses as the benchmark and makes sure that the proper tracks are laid down by the VTR for every frame in the video.
- At the time of playback ,the drum servo will possibly lock to the playback video itself or to an external reference from a central sync and will make sure that it reproduces the correct video with playing back the correct video tracks.

- Capstan servo

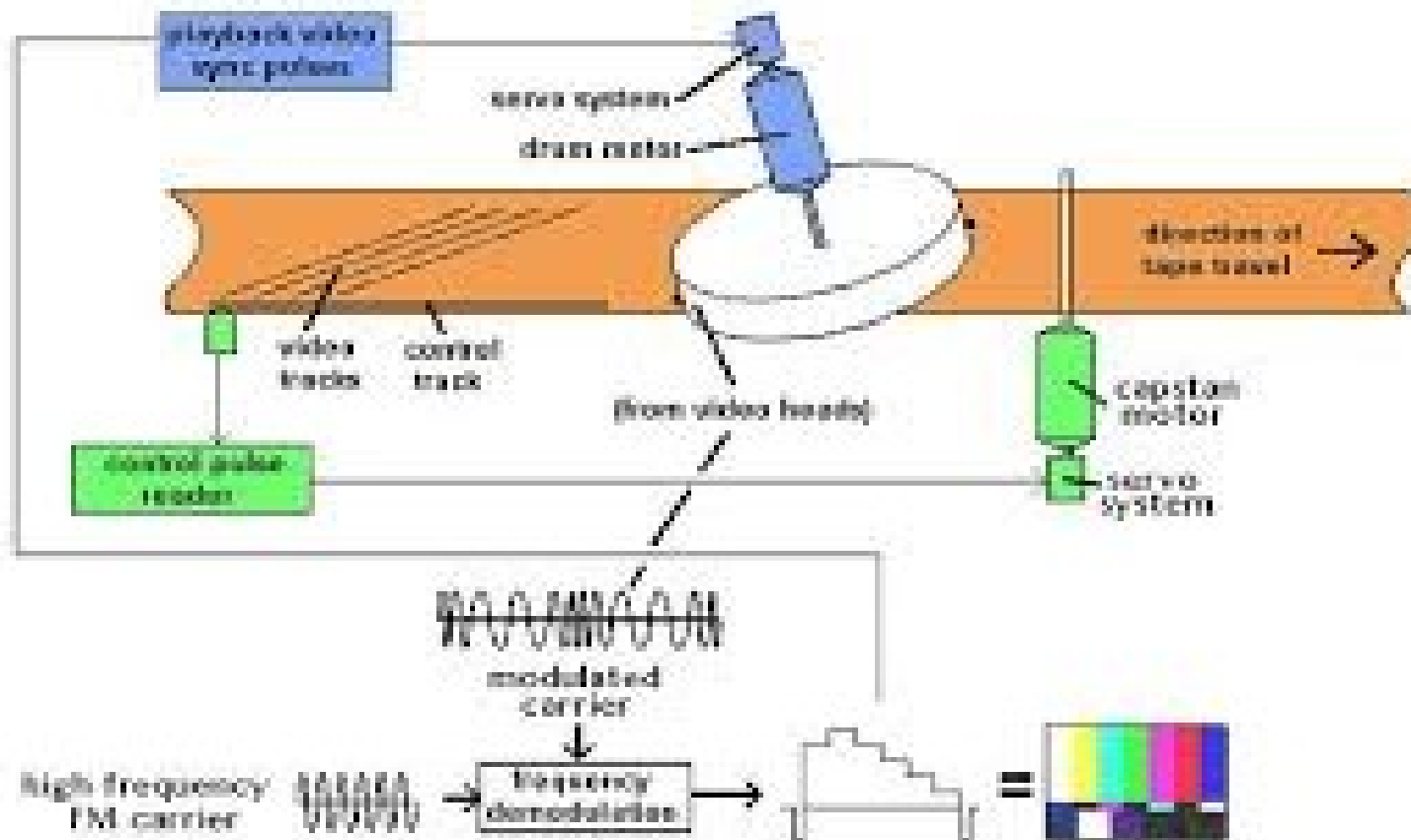
- ❖ With the capstan servo, it is ensured that the speed at which the tape gets pulled through the videotape recorder remains steady.
- ❖ At the time of recording, there is a specific speed at which the capstan motor runs and this is compared with the timing of the incoming video's vertical sync pulses
- ❖ In sync with this process, there is the laying down of a control track on the video tape.
- ❖ This is a pulse for every frame of video and for each second there are approximately 30 pulses.
- ❖ During the time of playback, the capstan servo checks the control track to ensure that the speed at which the tape is being played is correct
- ❖ With reference to broadcast VTRs , it is known as the external vertical sync pulses of the station
- ❖ Use of control track signal can also be made to set up position of the tape in relation to the ability of the video heads for picking up the tracks that have been recorded on the tape.

- It is the 'lock up' period that the speed is adjusted right after the play button is pressed to ensure that the video tracks are precisely lined up with the video heads sweeping by.
- The process ,referred to as 'tracking' generally needs a couple of seconds to take settle.
- This is a reason why ,in a production environment the VTR is rolled a few seconds prior to it being aired so that the VTR lock up period is taken care of before the actual airing

Videotape recording basics



Basics of video tape playback



University questions

1. Briefly explain MPEG compression. With block diagram explain the working of MPEG2 Encoder and decoder.(15 marks)(2018)
2. With a block diagram explain the working of analog video tape recorder .What are the advantages and disadvantages of analog video recording and playback systems.(2018)

- 5 marks

1. Write a brief note on MPED-4 standard?
(2018)
2. What are the advantages and disadvantages of digital video recording and playback?(2018)

- 2 marks

1. What is meant by “Video Compression”?
(2018)

• 1 mark(3rd n 4th module)

1. Capacity of double layer BLURAY disc is _____
2. Video bandwidth of colour “under scheme “ video recording is _____
3. Recording media used for analog video recording is _____
4. The fastest analog to digital converter is _____
5. In magnetic recording ,AC biasing is better than DC biasing because _____