



Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q.1 a) Attempt any three of the following:

16M

- i) **Compare AM and FM with respect to side bands, definition and modulation index.**

Ans: (4 marks for 3 points)

Parameter	AM	FM
No. of side bands	AM has two side bands	FM has infinite no of sidebands(theoretically) Practically:
Definition	AM is a system in which the amplitude of carrier signal is varied by the modulating voltage, whose frequency is invariably lower than that of the carrier.	FM is a system in which the amplitude of the modulated carrier is kept constant while its frequency and rate of change are varied by the modulating signal.



Modulation index	$m_a = V_m/V_c$ V_m = modulating signal voltage V_c = Carrier Signal voltage	$m_f = \delta/f_m$ δ = maximum deviation f_m = modulating frequency
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Note: [since only three parameters are mentioned in question paper 4 marks should be given for above three points]

ii) **What is PCM? State its advantages and disadvantage.**

Ans: PCM: **1M**

PCM technique is the breakthrough for moving from analog to digital communication. PCM technique is the process to represent message signal in digital form rather than the original analog form. PCM is a technique where input analog signal is quantized that is all amplitude values are rounded or approximate a group of nearby amplitude values are represented by a signal discrete amplitude value.

Advantages of PCM: **1 ½M**

- Measure advantages of PCM is that the information does not lie in any property of the pulse, but it lies in the presence or absence of the pulse, it makes no difference. So long as the decision regarding the presence or absence of the pulse is correct.
- Convenient for long distance communication.
- High transmitter efficiency.
- Good signal to noise ratio.

Disadvantages of PCM: **1 ½ M**

- Encoding, decoding and quantizing circuit of PCM is very complex.
- Requires large bandwidth compared to analog system.
- Quantization error, As 3.8V or 4.2V is quantized as 4V only.
- If due to noise, amplitude of pulse is unexpectedly below or above the threshold level, then receiver may misinterpret the pulse.

Note: [Any three from the above list]

iii) State aspect ratio, frame frequency, field frequency, video BW for CCIR-B standard.

Ans: Aspect Ratio: 4/3. 1M

Frame frequency: 25 frames/sec. 1M

Field frequency: 50Hz 1M

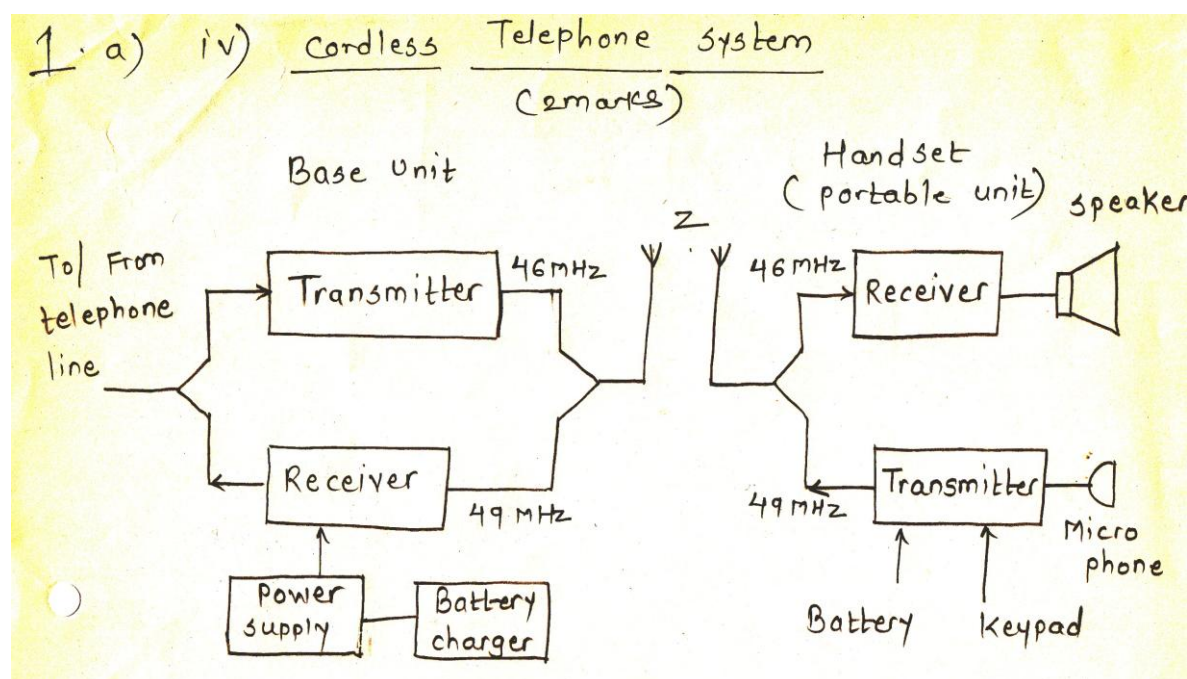
Video BW: 5MHz 1M

iv) Draw and explain block diagram of a cordless phone.

Ans:

Block Diagram:

2M



Explanation:

2M

A cordless telephone is a full-duplex, two way radio system made up of – Base unit and handset (portable unit).

The base unit is wired to the telephone line through modular connector. It receives its power from AC line the base unit is complete transreceiver in that it contains a transmitter that sends audio signal to hand set & It receives signals from handset and retransmits them on telephone line. It also contains a battery charger that rejuvenates the battery in handset.

The portable unit is also a full transreceiver. This unit is designed to rest in the base unit where its battery can be recharged.

Both units have an antenna.

Since both units are using full duplex operation transmitter and receiver must operate on different frequencies. The base unit transmitter operates in 43-46MHz range and receives in 49MHz range.



The portable unit has a receiver that operates in 43-46MHz range and transmitter operates in 49MHz range.

b) **Attempt any four of the following:** **6M**

i) **What is a MODEM? Explain different types of modes of data transmission.**

Ans: MODEMS:- **2M**

- Modem is very familiar word to everyone of us it is used for connecting a computer to a telephone lines.
- The telephones lines are designed to carry analog signal, and their bandwidth also is limited so they cannot be used for digital data transmission.
- A modems converts the digital data from computer to analog signals and put it on the telephone lines.
- It is a bi-directional device which converts the analog signals on the telephone lines into digital data when it is used for data reception.

Note: [Diagram for any of the mode is not compulsory.

Marks can be given even if only explanation is written or only following diagram are drawn. Explanation of each mode may only consist of definition or format.]

1. Parallel transmission : - **1M**

- In parallel transmission of data, all the bits of a byte are transmitted simultaneously on separate wires.
- This type of transmission requires multiple circuits for interconnecting the two devices.
- Parallel transmission is possible practically if the two devices are close to each other.
- For example parallel transmission takes place between a computer and its printer.

2. Serial transmission: - **1M**

- A serial transmission, the bits of a byte are serially transmitted one after the other.
- The byte to be transmitted is first stored in a shift register. Then these bits are shifted from MSB to LSB bit by bit in synchronization with the clock. Bits are shifted right by one position per clock cycle.
- The bit which falls out of the shift register is transmitted. Hence LSB is transmitted first.



- For serial transmission only one wire is needed between the transmitter and the receiver. Hence serial transmission is preferred for long distance data communication. This is the advantages of serial transmission over parallel transmission.

3. Asynchronous transmission: -

1M

- In asynchronous transmission, the transmitter commences transmission of data bytes at any instant of time.
- Only one byte is sent at a time. After sending one byte next byte can be sent after an arbitrary time delay.
- The transmitter and receiver operate at different clock frequencies.
- To help the receiver to receiver the data bytes “start” and “stop” bits are used alongwith each data byte as shown in fig. below. This start bit is always “0” and stop bit is always “1”

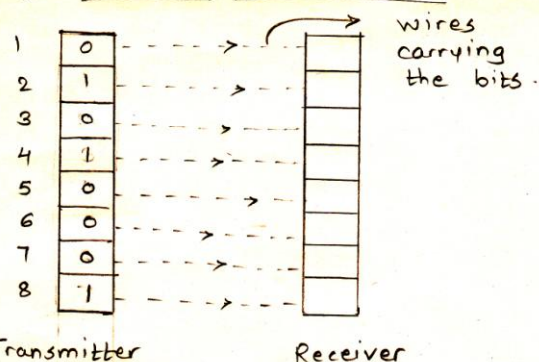
4. Synchronous transmission: -

1M

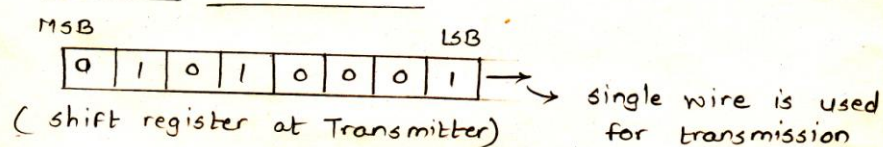
- Synchronous transmission carried out under the control of a common master clock. Here the bits which are being transmitted are synchronized to a reference clock.
- No start and stop bits are used instead the bytes are transmitted as a block in a continuous stream of bits as shown in fig. there is an inter block idle time which also is filled with the idle characters.
- The receivers operate at exactly the same clock frequency as that of transmitter.

OR

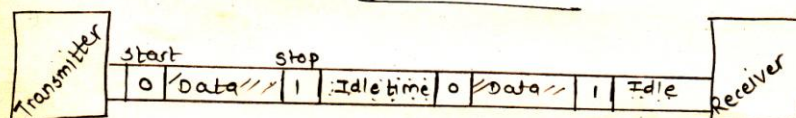
Q 1 b) i) Parallel Transmission



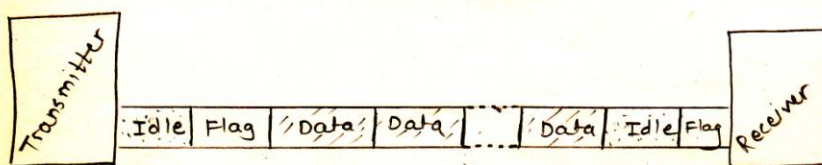
Serial Transmission



Asynchronous Transmission

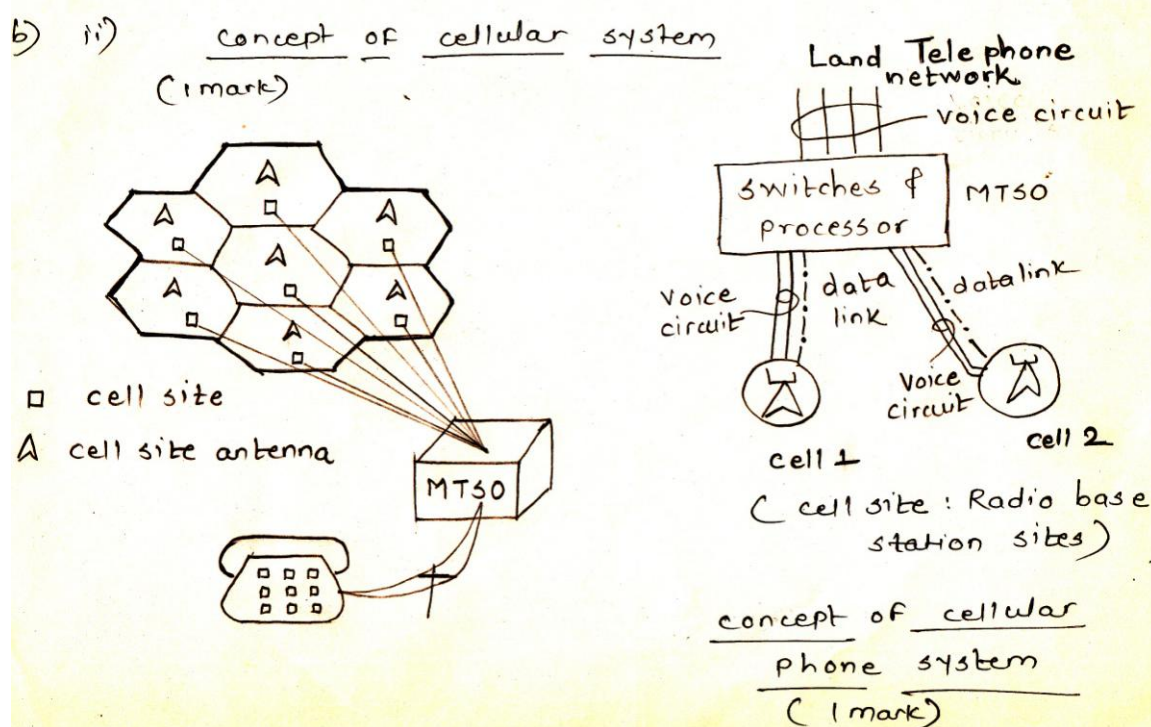


Synchronous Transmission



ii) Explain cellular concept. Explain the concept of cellular phone system.

Ans: (1 marks for diagram of concept of cellular system & 2 mark for its explanation, 1 mark for concept of cellular phone system, & 2 mark for its explanation)



Concept of cellular system:

The basic concept behind cellular radio system is that rather than serving a given Geographical area with a single transmitter and receiver, the system divides the service area into many smaller area known as cells.

OR

Cell: City is divided into small areas called 'cells'. Each cell is around 10 square kilometer (depends upon power of base station). The cells are normally thought of hexagons. Because cell phones and base stations use low power transmitters, the same frequencies can be reused in non-adjacent cell.

Cluster: A group of cells is called as cluster. The cluster size (n) is not fixed. It depends on the requirement of a particular area.

Concept of cellular phone system:

A basic cellular system consist of three parts Mobile Unit, Cell site & MTSO.

Mobile Unit: A mobile telephone unit contains a control unit, a transreceiver and an antenna system.

Cell Site (Base station) : the cell site provides interface between MTSO and mobile. It has a control unit, radio cabinets, antennas a power plant and data terminals.



MTSO: The mobile telephone switching office, the central coordinating element for all cell sites, contains the cellular processor and cellular switch. It interfaces with telephone company zone offices, controls call processing and handles billing activities.

Connections: The radio and high speed data links connect the three subsystems. Each mobile unit can only use one channel at a time for its communication link. But the channel is not fixed, it can be any one in the entire band assigned by the serving areas.

Q2. Attempt any four of the following: 16M

a) What is transmission bandwidth in a communication system? Comment on the bandwidth for AM and FM.

Ans: Transmission bandwidth 1M

The range of frequencies of a modulated signal required for the transmission is known as Transmission bandwidth.

Bandwidth of AM: $2 \times f_m$ 1M

Bandwidth of FM: $2 \times f_m \times \text{maximum no. of sidebands}$ 1M

Comment: Bandwidth of FM is more than that of AM because FM has more no. of sidebands 1M

OR

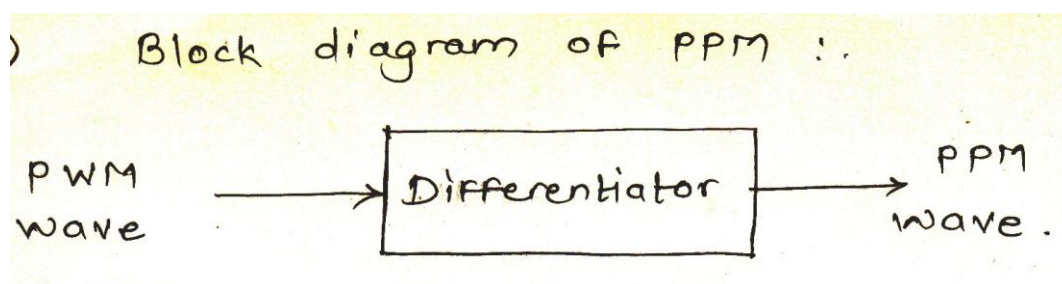
Bandwidth of narrow band FM = $2 \times f_m$

Bandwidth of wide band FM = $2 \times f_m \times m_f$

b) Explain the working of PPM. Draw neat waveforms.

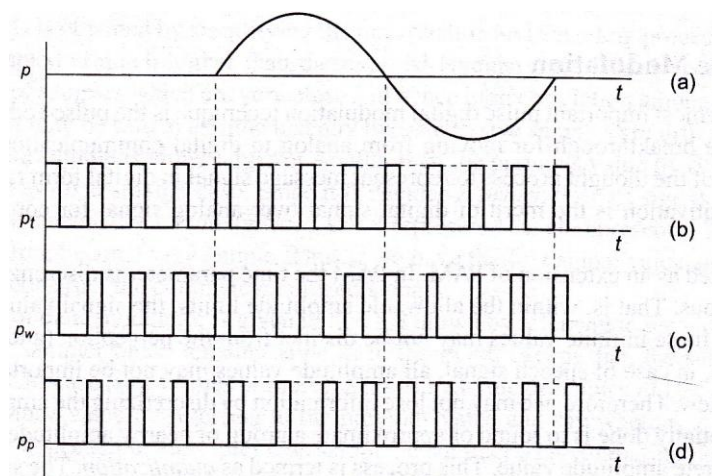
Ans: Note: [PPM modulator using IC 555 is not required]

Block Diagram: 1M



Waveforms:

2M



Explanation:

1M

PWM (Pulse Width Modulation) is generated by varying the width of the trailing edge, then this edge will be extracted to get the position of the pulse in each period.

Once the position is extracted, the leading or trailing edge of the pulse is placed at this instant.

The amplitude and width of the pulse remain constant as in the original pulse train.

c) **Explain with respect to a colour TV system- Luminance, Hue and Saturation.**

Ans: *Note: [Since only three definitions are asked in question paper. 4 marks should be given to below answer]*

Luminance: It is the measure of visual sensation of the quantity or brightness of light emitted from a pixel.

OR

This not equally sensitive to all colours. Its sensitivity for green is 59%, for red 30% and for blue 11%.

Therefore, $Y = 0.59G + 0.30R + 0.11B$

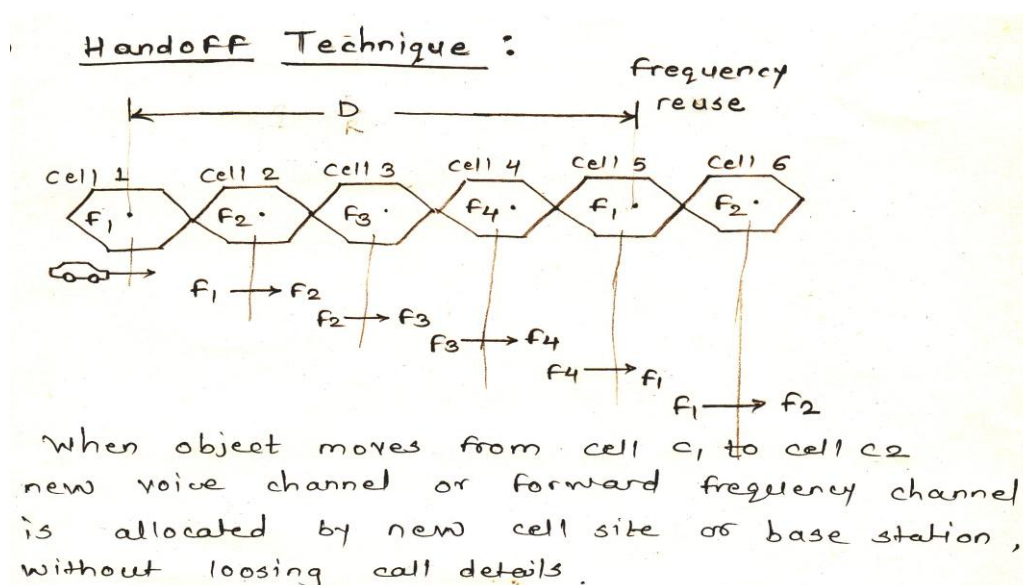
Hue: This is the predominant spectral colour of the received light. Thus the colour of any object is distinguished by its hue or tint. e.g. the green leaves have green hue and red tomatoes have red hue.

Saturation: This is the spectral purity of the colour light. Since hue colours occur rarely alone, this indicates the amounts of other colours present. Thus saturation may be taken as an indication of how little the colour is diluted by white.

d) **Explain the concept hand off technique.**

Ans: Diagram:

2M



Explanation:

2M

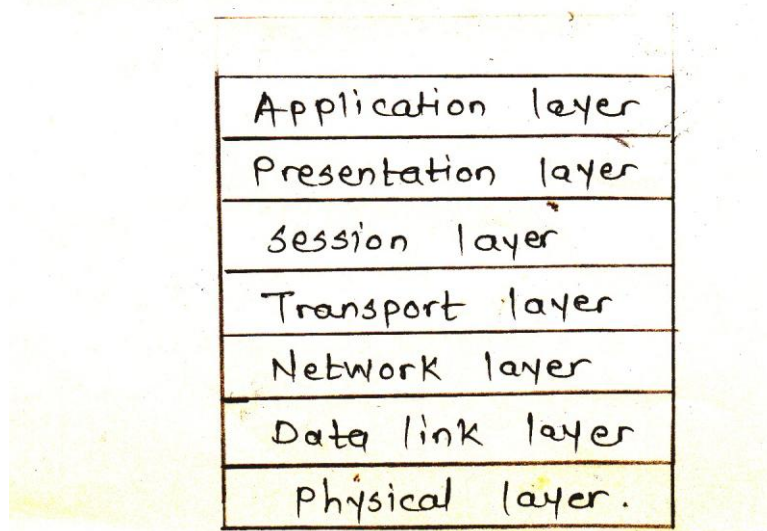
Dialing the call, two parties are on a voice channel. When the mobile unit moves out of the coverage area of a particular cell site (base station) the reception becomes weak. The present cell site requests a handoff. The system switches the call to a new frequency channel in a new cell site without earlier interrupting the call or alerting the user. The call continues as long as the user is taking.

The computer at MTSO causes transmission from weaker cell to the stronger cell. All of this takes place in a very short period of time & is completely unnoticeable to user.

e) **Sketch and label OSI reference model. Explain in brief.**

Ans: Diagram:

2M

OSI Reference Model :

Brief explanation of OSI layer:

2M

Physical layer: Make and break connections, convert data bits into electrical signals.

Decides transmission is simplex, half duplex or full duplex.

Data link layer: Synchronization, error detection and correction.

Network layer: Acts as network controller for routing data.

Transport layer: Decides whether transmission should be parallel or serial, multiplexing

Session layer: It controls logging, user identification and billing management.

Presentation layer: It works as a translating layer. Also does encryption, compression.

Application layer: It allows the users to use mail, allows to access, download, upload files.

f) **Explain the features of LAN.**

Ans:

Note: [Any 4 features ,each 1 mark]

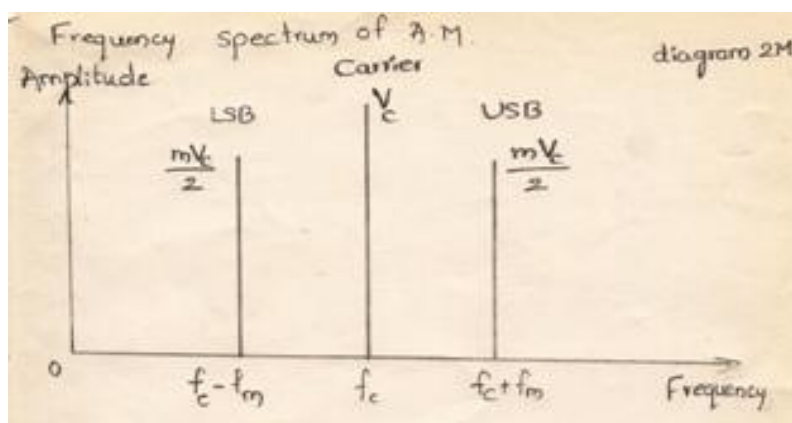
- The Local Area Network(LAN) is a network which is designed to operate over a small physical area such as an office, factory or group of buildings.
- LANs are easy to design and troubleshoot. The personal computers and workstations in the office are interconnected via LAN.
- In LAN all the machines are connected to a single cable. Different types of topologies such as Bus, Ring, Star, Tree etc are used for LANs.
- LAN is capable of operating at hundreds of Mbits/sec.

- LANs are widely used to allow resources like printer or data files to be shared between personal computers or workstations.

Q.3 Attempt any four of the following: 16M

a) Draw frequency spectrum of AM. Explain its features. 2M

Ans: Diagram 2M



Features of AM frequency spectrum 2M

AM wave contains three contents

The first term $V_c \sin \omega_c t$ is the equation of carrier wave. It represents un-modulated carrier wave.

- Second and third terms represent the two side bands LSB (Lower side band) and USB (upper side band)

1) LSB has frequency $f_c - f_m$ and magnitude $\frac{mV_c}{2}$.

2) USB has frequency $f_c + f_m$ and magnitude $\frac{mV_c}{2}$.

- The total bandwidth can be calculated by the frequency spectrum of AM.

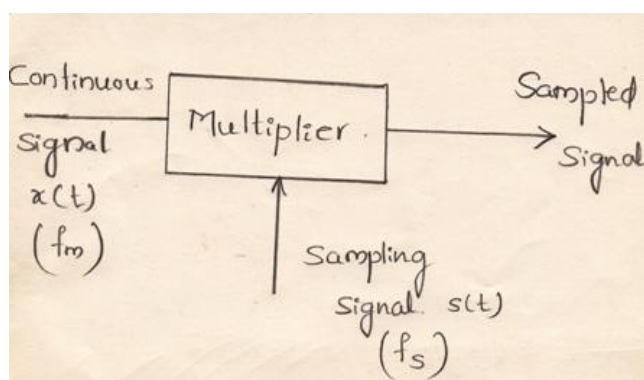
$$\begin{aligned} \text{Band width} &= \text{USB frequency} - \text{LSB frequency} \\ &= (f_c + f_m) - (f_c - f_m) \\ &= f_c + f_m - f_c + f_m \\ &= 2f_m \end{aligned}$$

b) Define sampling theorem. State Nyquist criteria. 2M

Ans: Definition : 2M

A continuous time signal $x(t)$ can be completely represented in its sampled form and recovered back from the sampled form if the sampling frequency $f_s \geq 2f_m$, where f_m is the maximum frequency of the continuous signal.

Note: [Diagram is optional]



Statement of Nyquist criteria.

2M

It is the minimum sampling rate required to represent the continuous signal $x(t)$ “faithfully” in its sampled form.

According to the sampling theorem, the Nyquist rate is $f_s = 2f_m$.

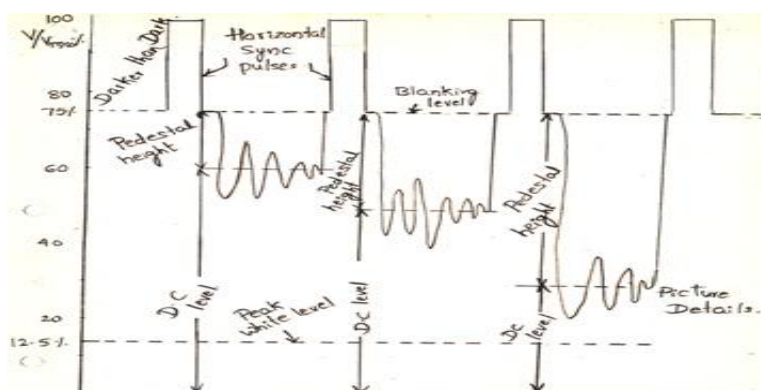
If the sampling frequency f_s is less than the Nyquist rate distortion called “Aliasing” is introduced.

c) Draw and explain colour composite video signal in a colour TV system.

Ans:

Diagram:

2M



Explanation of colour composite video signal.

2M

- Colour composite video signal consists of different signals such as blanking pulses, burst signal, horizontal and vertical sync pulses, luminance signal colour picture information etc.
- 12.5% voltage level is called peak white level which corresponds maximum whiteness.
- 75% voltage level is called blanking level. Where blanking pulses are added.
- 72% is called black level above that picture gets darker than dark.
- As DC level is decreased, whiteness of picture gets started.

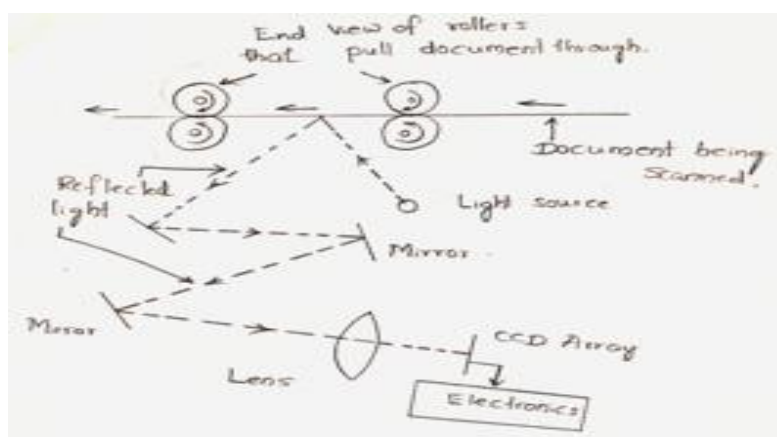
Note:- [if student is not mentioned the % values of levels, marks to be given.]

d) **Explain Scanning mechanism in FAX machine.**

Ans:

Diagram:

2M



Explanation:

2M

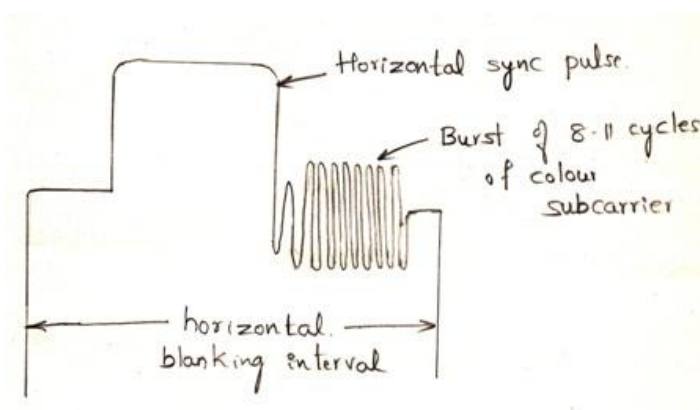
- CCDs are available with a matrix of many thousands of pixels, thereby permitting very high resolution picture transmission.
- In fax machines, the entire document is not focused on a single CCD, instead, only a narrow portion of the document is lighted and examined as it is moved through the fax machine with rollers. A complex system of mirrors is used to focus the lighted area on the CCD.

- The modern fax machines use another type scanning mechanism that does not use lenses. The scanning mechanism is an assembly made up of LED array and CCD array.
- The 2048 pixels of light are converted to voltage proportional to the light variations on one scanned line. These voltages are converted from parallel format to a serial voltage signal. The resulting analog signal is amplified and sent to an AGC circuit & S/H amplifier. The signal is then sent to A/D converter where the light signals are translated to binary data words for transmission.

e) **Draw and explain the colour burst-signal in TV.**

Ans: Diagram:

2M



Explanation:

2M

Colour burst signal is transmitted with along with sync pulses at the back porch of the line blanking period.

- The transmitter provides a reference phase by generating a continuous sine wave of subcarrier frequency at a phase standardized at 180° . ie. Along (B-Y)
- As colour burst signal is added at horizontal blanking interval. During this period, luminance signal is zero. Thus there is practically no visibility on the receiver.
- Peak to peak amplitude of colour burst signal is same as that of height of sync pulse.

Q.4) a) Answer any three of the following:

12M

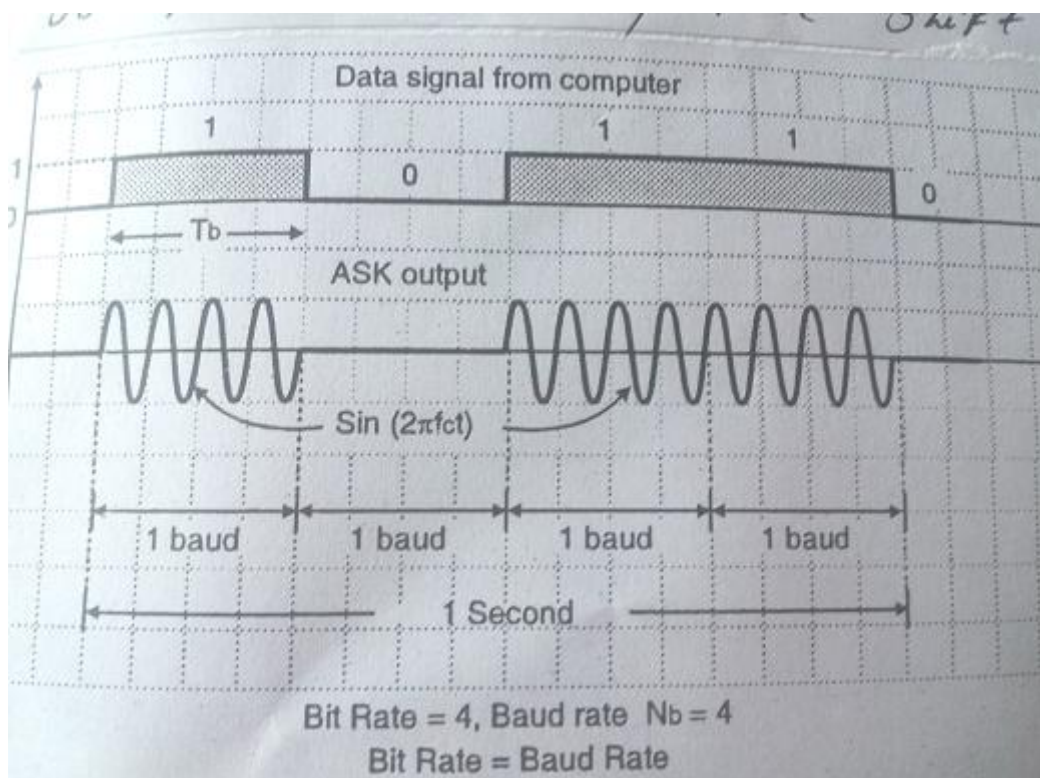
i) Define ASK, FSK, PSK and draw its waveform.

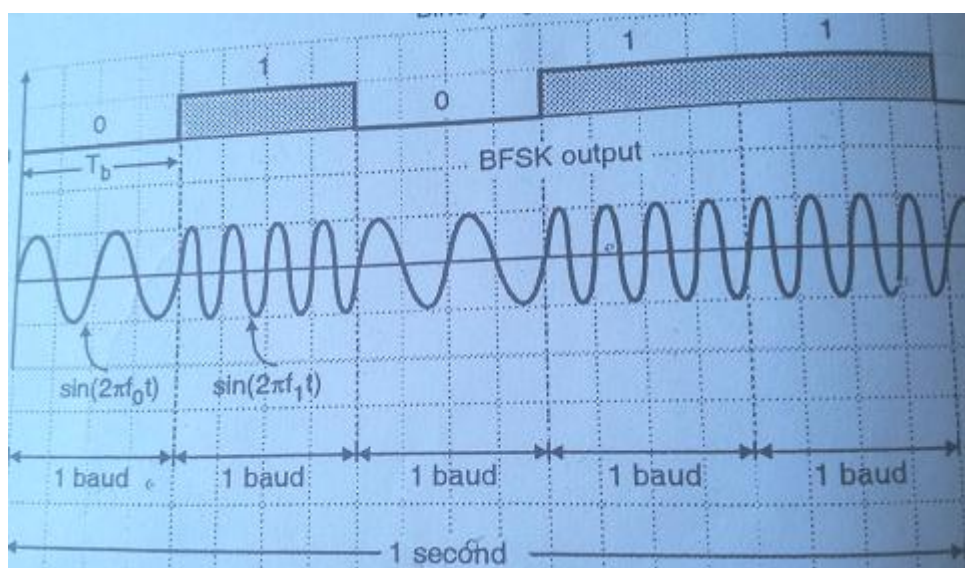
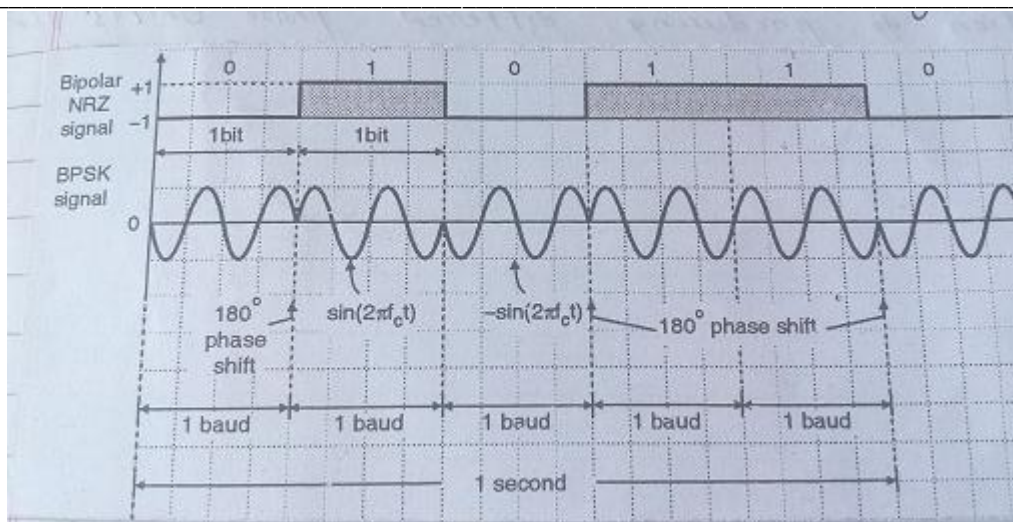
Ans: (1 mark each for drawing all the 3 waveforms and 1 mark for writing the definition)

ASK – In Amplitude shift keying, the amplitude of carrier is varied to represent binary 1 and 0. Both frequency and phase remains constant. In ASK amplitude shifts only in two levels high and low so known as amplitude shift keying.

FSK- In frequency shift keying, the frequency of a sinusoidal carrier is shifted between two discrete values where amplitude and phase remains constant.

PSK- In phase shift keying, the phase of carrier is varied or shifted to represent binary 1 and 0. Both amplitude and frequency remains constant.





ii) Why AM is used for picture transmission and FM for sound transmission in a TV system.

Ans: (2 marks for writing about AM video transmission and 2 marks for writing about FM sound transmission)

FM provides noise free and high fidelity output. For a TV channel, for high video frequencies the channel bandwidth of 7MHz is used. The highest audio frequency is 15 KHz, so side bands do not extend too far.

- This can be easily accommodated around the sound carrier that lies 5.5 MHz away from the picture carrier.
- The bandwidth assigned to FM sound signal is 200 kHz.



Thus without disturbing much on available band space for television transmission, FM is suitable for sound transmission.

Reasons AM used for video transmission:

- a) At UHF and VHF for the carrier frequencies there is a displacement in time between the direct and reflected signals. The distortion occurs due to interference between multiple signals, because in FM the frequency of FM continuously changes. Whereas in AM the multiple signal paths can produce a ghost image which is steady.
 - b) If FM were used for picture transmission, the changing beat frequency between the multiple paths, delayed with respect to each other, produces a bar interference pattern in image, the picture is rarely steady.
 - c) Also the circuit complexity and bandwidth requirements are much less in AM than FM.
- Hence AM is preferred for picture transmission than FM.

Note: [Any two points are expected]

ii) **Define compatibility in a TV system.**

Ans: (2 Marks for writing definition of compatibility and 2 Marks for writing about reverse compatibility)

The black and white TV was used first. When colour TV was designed, the TV was designed in such a way that the colour TV transmission can be received on B/W TV. This is called compatibility.

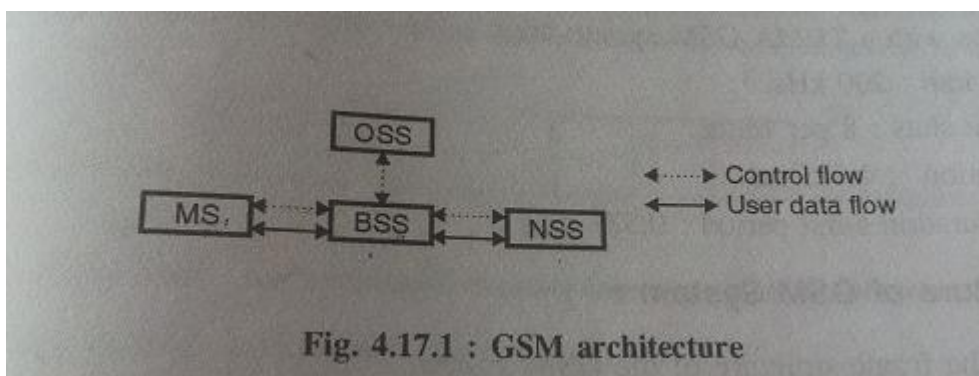
It was necessary to ensure the compatibility in the opposite direction i.e. B/W transmission should be received on the colour TV.

Conditions for compatibility :

- 1) The brightness or luminance signal which is used by the monochrome TV receivers should be derived from the colour signal.
- 2) The bandwidth of compatible colour TV should be same as that of B/W transmission.
- 3) The location and spacing of the picture and sound carriers in colour transmission should be same as those in monochrome transmission.
- 4) Transmission of Chroma information should be such that colour reproduction is proper, and ignored by B/W TV.

iv) Describe GSM architecture and call processing in a GSM system.

Ans: (2 marks for writing architecture and 2 marks for writing about call processing)



GSM system consists of many subsystems:

1. Mobile Station (MS)
2. Base station subsystem (BSS)
3. The network and switching subsystem(NSS)
4. Operating subsystem (OSS)

Mobile station (MS) It is used to support the connections of the external terminals such as PC or FAX.

Base Station Subsystem (BSS) The BSS gets connected to MS through a radio interface. It also gets connected to NSS. GSM uses the OSI model.

NSS: NSS is designed to manage the communication between GSM users and other communications users.

OSS : It look after network operation and maintenance, billing and management of mobile. GSM uses the Gaussian minimum shift keying (GMSK).

Note: [Student should get credit of elaborated GSM architecture as drawn using all VLR, HLR, AU, and BTS, MS.....]

Call processing :



Initialization : When the user turns on the mobile station, the initializations starts. MS must tune to the strongest control channel within 3 sec, otherwise it searches for the second strongest channel within the next 3 sec interval. Check whether it is in Enable or disable status.

When the call is handset to handset then from first handset call is forwarded to MTS, it checks whether the call is for mobile or landline, if it is for mobile handset then MTSSO connects call to called handset. (Forward direction)

If it is for landline then it is connected to telephone exchange and forwarded to the landline phone. (Reverse direction)

Note: [brief idea about call processing is desirable]

b) Attempt any one of the following:

6M

i) Draw and explain mono-chrome TV transmitter.

Ans: (3 marks for diagram, 3 marks for explanation)

Note: [explanation can be written in brief look for keywords and important blocks]

1. TV transmitter :

TV camera – It converts the optical information such as intensity, colour etc. into an electrical signal. This is a video signal.

Video amplifier- The video amplifier is a wideband amplifier of BW 5MHz. A synchronizing signal is added to the video signal. It is used for controlling the horizontal and vertical scanning of the TV camera.

Modulator : The amplified video signal acts a modulating signal. The RF oscillator produces a very high frequency carrier signal. The video signal ‘Amplitude modulates’ the RF carrier.

Power amplifier : The power amplifier is used to raise the power content of the amplitude modulated video signal , so that the transmitted signal can reach a long distance.

Diplexer : This is a combining network which connects the outputs of video section as well as the sound section to a common transmitting antenna and also isolates it.

Microphone – It converts the sound signal into an equivalent electrical signal.

Sound amplifier : It amplifies the weak audio signal coming from the microphone. This amplified audio signal is then applied as a modulating signal to the sound modulator.

Sound modulator : The audio signal is frequency modulated. It is then applied to a power amplifier.

Transmitting antenna : The transmitting antenna converts the AM video signal + FM audio signal into electromagnetic wave. The transmitting antennas are installed on hill tops or on tall buildings to increase the range of communication.

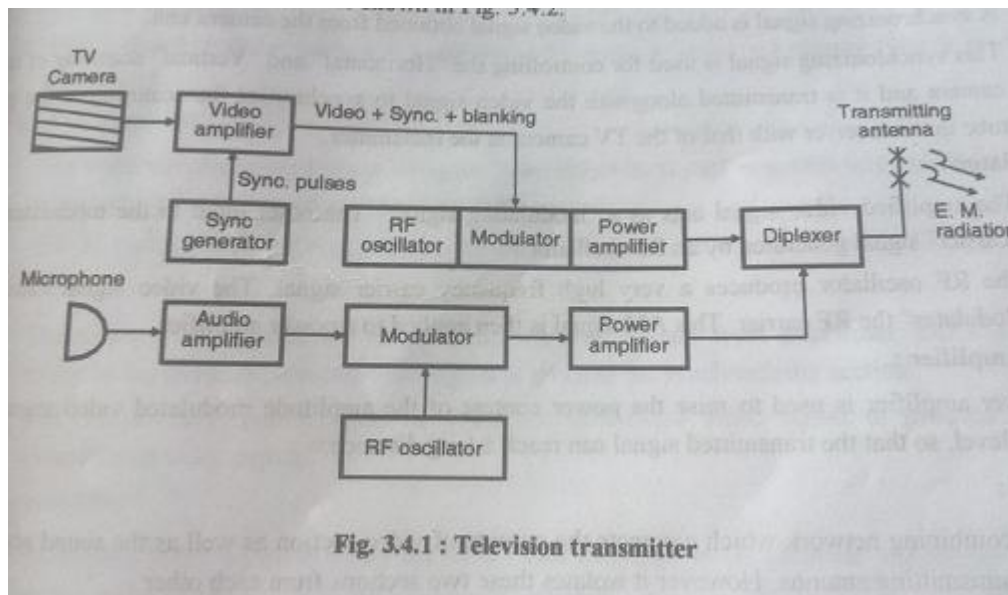


Fig. 3.4.1 : Television transmitter

ii) **Explain cell splitting and frequency reuse in a mobile communication system.**

Ans: (2 marks for cell splitting, 2 marks for frequency re use.)

(1 mark for diagram of frequency reuse and 1 mark for cell splitting diagram)

In order to improve the spectrum efficiency of a cellular mobile systems, we can use

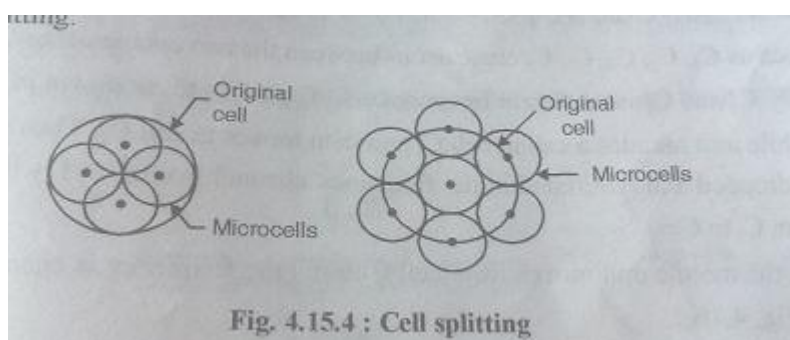
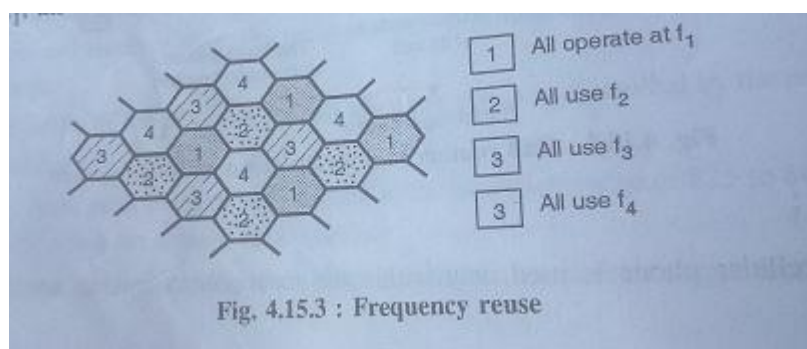
i) Frequency reuse : It can be done at time domain and space domain.

In time domain the same frequency is used by different users in different time slots.

This is TDM time division multiplexing.

In space domain :

1. Same frequency is assigned in two different geographical areas.(ie in two different cities.)
2. To use the same frequency repeatedly i.e. the total frequency spectrum allocation is divide into 4 co-channel cells in the system. The cells marked 1 will use the same frequency say f_1 , the cells marked 2 will use same frequency f_2 .



Cell splitting : For handling maximum cellular traffic, cell splitting is used for additional growth within the cell. The cell boundaries need to be revised so that the local area which was considers a single cell now consists of smaller cells. The new radius is one half of the original radius. The transmitted power and antenna heights of the new base stations are reduced accordingly. The same set of frequencies is used again.

Q.5) Attempt any four of the following:

16M



- a) **Define modulation index in FM and explain how does it affect the bandwidth required for FM channel.**

Ans:

a) modulation index of FM

1M

The ratio of frequency deviation to the modulating frequency is known as the modulation index.

$$M_f = \Delta f_c / f_m$$

Effect of modulation index on bandwidth

1M

According to Carson's rule

$$\text{Bandwidth} = 2 f_m (M_f + 1)$$

Depending upon the value of M_f bandwidth are classified into two

1) Narrow bandwidth

2) Wideband width

Narrow bandwidth (NBFM)

1M

$$BW = 2 f_m (M_f + 1)$$

IF $M_f \ll 1$, then $BW = 2 f_m$

This bandwidth is same as AM.

Wide bandwidth (WBFM)

1M

$$BW = 2 f_m (M_f + 1)$$

IF $M_f \gg 1$

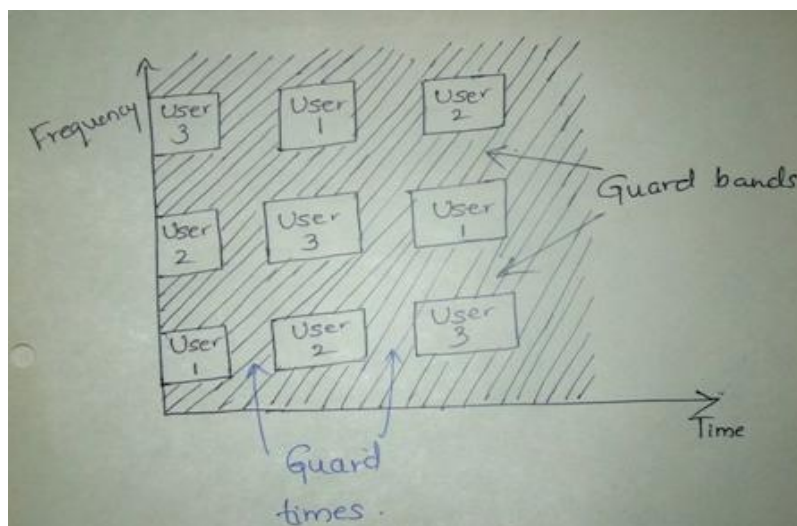
Then equation reduces

$$BW = 2 f_m (M_f)$$

- b) **Explain CDMA cellular telephone system with neat diagram.**

Ans: Diagram:

2M



Explanation:

2M

CDMA (code division multiple access)

In CDMA, more than one user is allowed to share a channel or sub channels with the help of direct sequence spread spectrum signals.

Each user is given a unique code sequence or signature. This sequence allows the user to spread the information signal across the assigned frequency band.

At the receiver, the signal is recovered by using the same code sequence.

The signal received from various users are separated by checking the cross correlation of the received signals with each possible user signature.

Bandwidth as well as time of the channel is being shared by the users, it is necessary to introduced guard times and guard bands.

c) State the electrical specifications of RS-232 C.

Ans: (Each specification 1M)

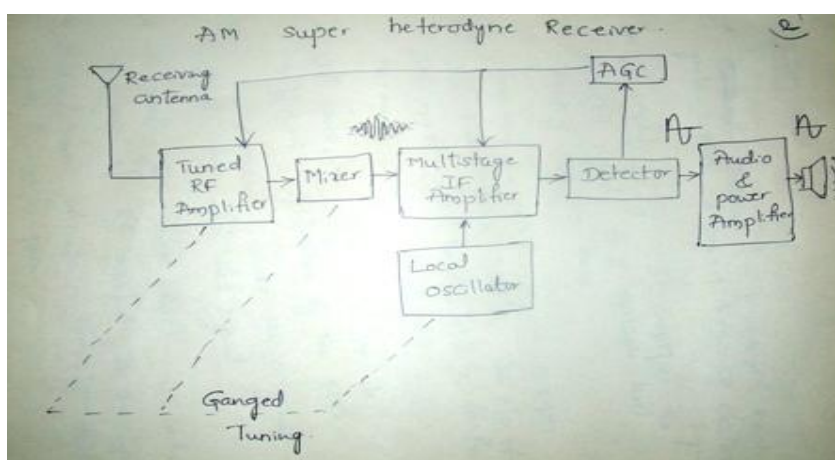
Note: [Any other relevant specification, marks should be given]

- The binary data can be represented by two different voltage values. A binary '1' is called as mark and binary '0' is called space. As per RS -232 standards, the voltage ranges for representing mark & space are well defined.
- A mark that is binary '1' is represented by voltage between -3 volts to -25 volts.
- A space that is binary '0' is represented by voltage between -3 volts to +25 volts.
- The voltage range between -3 volts to +3 volts is treated as invalid range. There should not be any mark or space voltages within this 6 volts wide.

d) Draw the block diagram of superheterodyne AM receiver and explain its working.

Ans: Diagram:

2M



Working:

2M

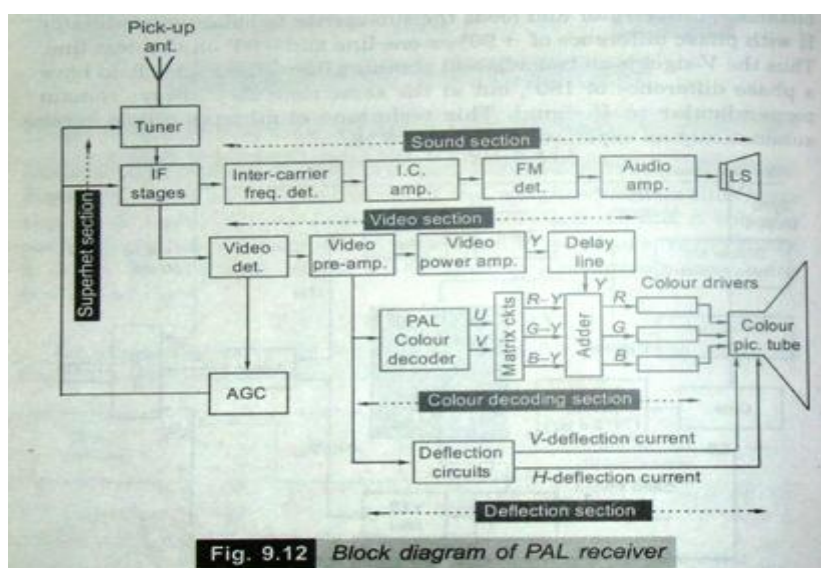
- Antenna receives the transmitted electromagnetic signals and converts them into electrical signals.
- RF amplifier stage : it amplifies the selected signal to a suitable level and feeds to the mixer.
- Frequency converter stage : accepts the two signals f_s and f_o , the output of mixer may be $f_o, f_s, f_o + f_s$ or $f_o - f_s$. normally it is $f_o - f_s$.
- IF amplifier stage : it provides sufficient amplification for $f_o - f_s$ that is 455 KHz.
- The detector recover the original signals from modulated signals.
- Automatic gain control (AGC): it controls the gain of RF amplifier, IF amplifier.

- Audio & power amplifier: amplifies audio and power of the signal.

e) **Explain the working of PAL-D receiver with block diagram.**

Ans: Diagram:

2M



Super heterodyne section:

2M

- Super heterodyne section receives electromagnetic waves & tune to 38.9 MHz for video 33.4Mhz for audio.
- IF amplifier improves sensitivity and gain.

Video section:

- The colour composite video signal is recovered at the output of video detector.
- Video amplifier provides a wide band amplifier & video power amplifier gives sufficient high output to drive phosphor element of picture tube to glow.
- Y signal (luminance) is separated from Chroma signal using come filter or band pass filter to pass bandwidth of 3.13 Mhz.
- Y signal (luminance) goes to video power amplifier & chroma signal goes to colour decoder.

Colour decoding section:



- The PAL colour decoder produces the colour difference signals U & V.

$$U = 0.493 (B-Y), V = 0.877 (R-Y)$$

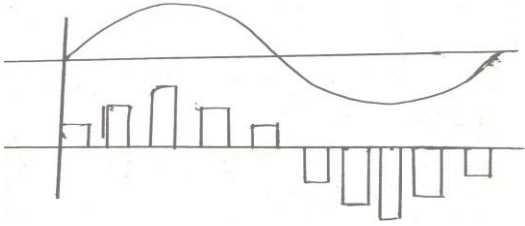
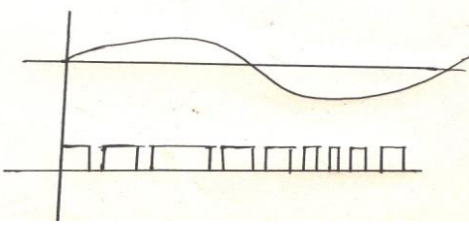
- U & V signals are detected using balance modulator.
- The third colour difference signal (G-Y) is obtained by the resistive matrix.
- The three amplified colour signals are field three electron guns of the colour picture tube.

Sound section:

- Inter carrier frequency detector gives inter carrier frequency signals containing frequency deviation of FM.
- Normally phase shift discriminator is used to detect the audio signals & then given to the amplifier.

f) Compare PAM and PWM for definition, waveform, and advantages and application.

Ans: (Each point 1 marks)

Parameter	PAM	PWM
Working principle	The amplitude of pulses varies in accordance to the amplitude of information signal.	Width of the pulse is varied in accordance with the amplitude of information signal.
Application	PAM-TDM based T ₁ Telephony system.	Radio telemetry for removing & sensing
Advantages	Simple to generate	Amplitude of the pulses is constant therefore power to be transmitted is constant.
Waveform		



g) What is colour difference signal in a colour TV system?

Ans: Explanation:

4M

The purpose of generation of color difference signal is to avoid transmission of R, G,B separately.

The three possible color difference signal are (R-Y),

(G-Y) and (B-Y). these are obtained by subtracting each of the three color outputs.

It is convenient to transmit (R-Y) and (B-Y) while (G-Y) is obtained at the receiver by suitable matrices.

$$Y = 0.30 R + 0.59G + 0.11B$$

$$(G-Y) = 0.51(R-Y) + 0.186(B-Y)$$

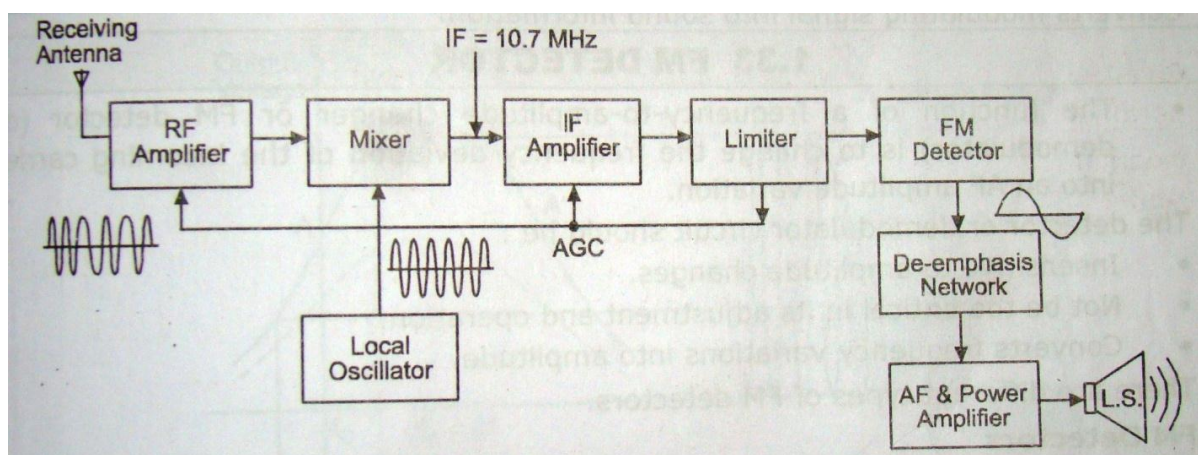
Thus to obtained (G-Y) signal from (R-Y) and (B-Y) signal , a suitable resistance matrices can be used at the receiver with minimum amplifiers.

Q.6) Attempt any four of the following:

16M

a) Explain the working of FM receiver with neat block diagram.

Ans: (2 marks for diagram, 2 marks for explanation)(brief explanation is expected, look for keywords and important block explanation)



Antenna :- The antenna of an FM receiver is generally half wave dipole for the 88-108MHz band.

RF tuner:- The RF tuner includes an RF amplifier & frequency converter (Mixer + local oscillator). RF amplifier is always used in FM receiver. It reduces effect of noise image frequency interference, the possibility of oscillator radiations from the antenna etc. It is tuned to the RF carrier frequency in the 88 to 108MHz band.

There are two stages of frequency conversion

The first frequency converter circuit converts the incoming RF signal to an IF signal of 10.7MHz. This is done by beating the incoming signal frequency with the local oscillator frequency in the mixer. At the output of the mixer only the difference frequency which is the IF of 10.7MHz is selected and fed to the second frequency converter

The second frequency converter circuit converts the incoming RF signal to an IF signal of 455KHz. This signal is fed to the IF amplifier section.

The first IF is kept high for good image frequency rejection and second IF is a relatively low frequency that allows the IF amplifiers to have relatively high gain & still not be susceptible to oscillating.

IF amplifier section:- IF amplifier are tuned to 10.7MHz and have a bandwidth of approximately 200KHz. They amplify the IF signal at the output of the tuner to a sufficiently high level before feeding to the limiter stage.



Limiter:- The FM wave which is transmitted by the FM transmitter has constant amplitude. But during propagation, noise & other unwanted signal get added to it & change its amplitude. These unwanted amplitude changes must be removed before signal goes for demodulation otherwise distortion appears in the demodulation signal as the demodulators react to amplitude changes as well as frequency changes

The amplitude limiter will remove all the unwanted amplitude variations from the received signal. This circuit is basically an IF amplifier tuned to 455KHz.

FM detector:- The FM detector circuit recovers the audio information from the FM signal. **De-emphasis network:** It is used in the receiver to compensate for pre-emphasis carried out at the transmitter. De-emphasis is accompanied with a correspondence reduction in noise.

Audio amplifiers:- Those perform the function of raising the power level of the audio signal to a sufficient high value so as to satisfactorily drive the loud speaker.

b) Explain different tones used in telephones.

Ans: (1 mark for each tone)

Note: [marks can be given for either diagram or explanation]

1) **Dial tone :** This tone indicates that the exchange is ready to accept dialed digits from the subscriber. The subscriber should start dialing only after hearing the dial tone. The 400 Hz signal is usually modulated with 25 Hz or 50 Hz.

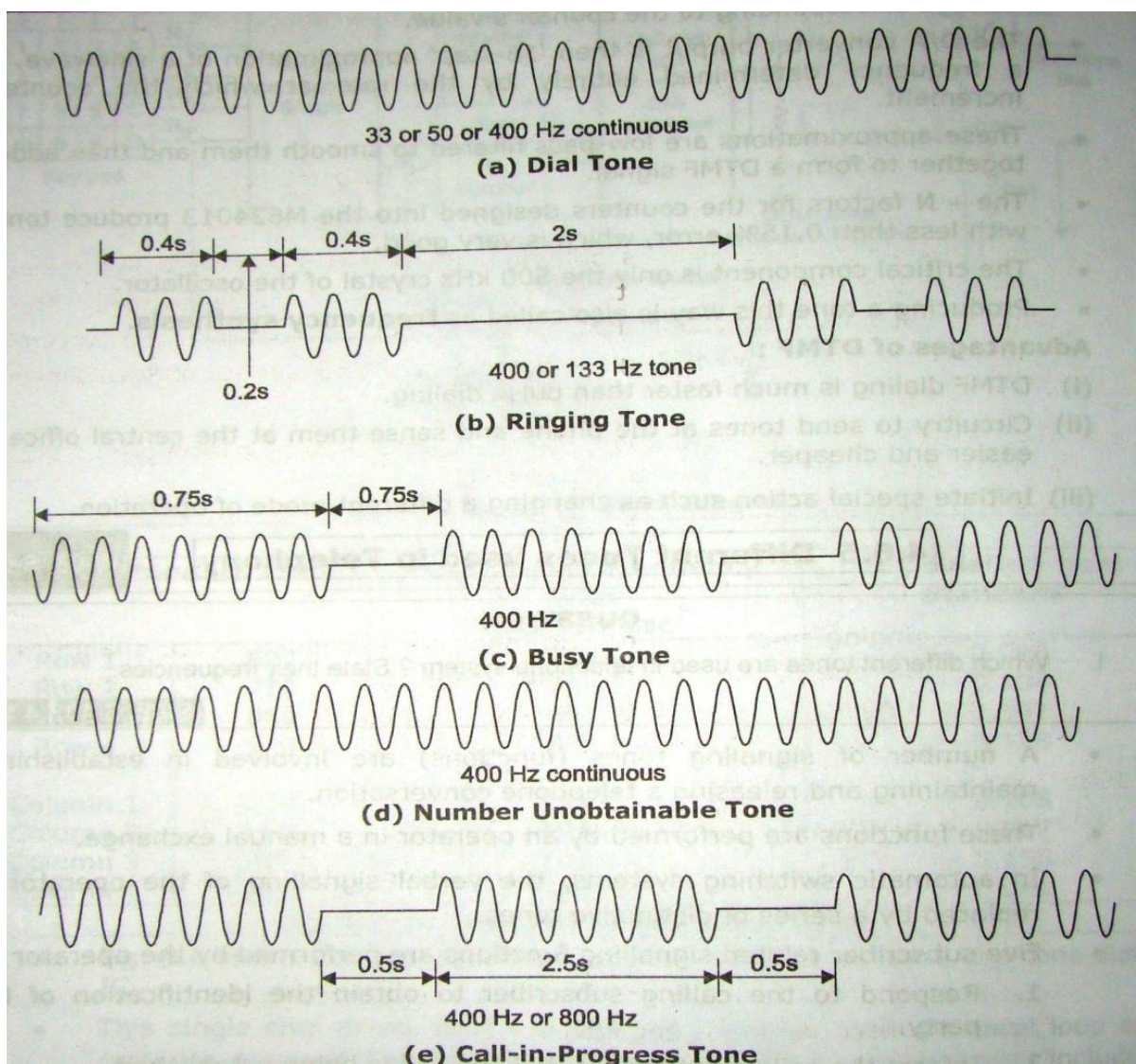
2) **Ringing tone :** When the called party line is obtained, the exchange control equipment send out the ringing current to the telephone set of the called party. Simultaneously, the control equipment sense out a ringing tone to the calling subscriber. The frequency of ringing tone is 133 Hz or 400 hZ, sometimes modulated with 25 Hz or 33 Hz.

3) **Busy tone :** It is a ring burst 400 Hz signal with silence period in between. A busy tone is sent to the calling subscriber whenever the switching equipment or junction line is not available to put through the call, or called part is engaged.

4) **Number obtainable tone :** This tone may be sent to the calling subscriber due to variety of reasons such that the called party is out of order or called party is disconnected or an error in dialing leading to the selection of space.

5) Routing or call in progress tone :

When a subscriber call is routed through a no. of different types of exchanges, this tone is issued. It is usual that a subscriber in a new area where the frequencies or timings of the tones are different from those in his own area confuses signaling tone. In order to overcome this problem, recorded voices that announce messages in modern exchanges.



c) Compare WAN and MAN for 3 points.

Ans: (1 mark for each point)(3 points are asked, 4 marks for any 3 points)

Parameter	MAN(Metropolitan area	WAN(wide area network)

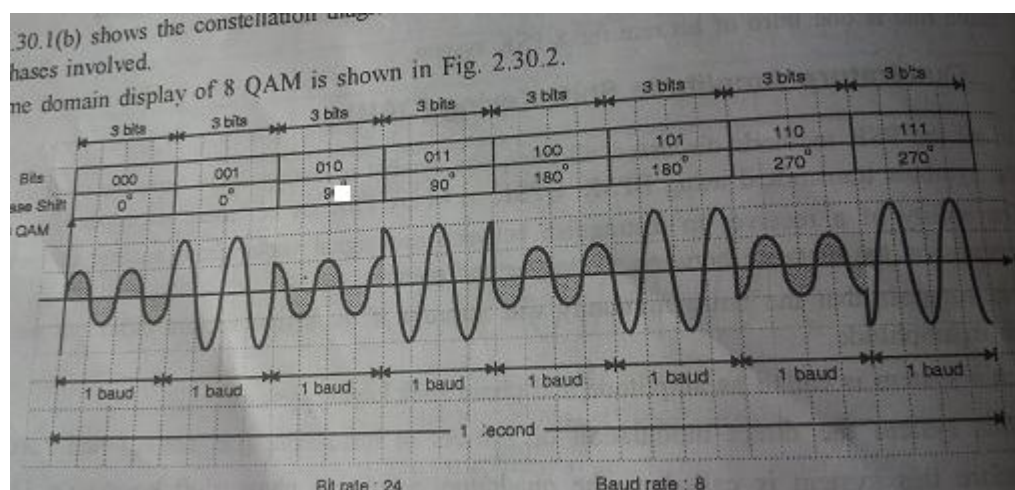
	network)	
Network type	Bigger version of LAN. Can extend over an entire city.	Spans widely, terminals are located all over the country, country to country
Communication medium	STP and fiber optic cables	PSTN and satellite links.
Principle	broadcasting	switching
applications	Complexes, private companies	Airline reservation, internet .

d) Explain basic principle of QAM with help of waveforms.

Ans: (2 marks for explanation, 2 marks for waveform)

QAM – In all the PSK methods, one symbol is distinguished from the other in phase, the symbols transmitted using BPSK, QPSK or M-ary PSK are of same amplitude. It uses both AM and PM of a carrier. In addition to producing different phase shifts the amplitude of the carrier is also varied. In this system the direct modulation of carriers in quadrature ($\cos \omega_c t$ and $\sin \omega_c t$) is involved.

This system uses four different phase shifts as in QPSK and two carrier amplitudes. With four possible phase shifts and two different carrier amplitudes, a total of eight different states can be transmitted.





e) **Compare Simplex and Duplex communication system for two points**

Ans: (2 marks for each point)

Parameter	Simplex	duplex
Definition	Communication is one way	Communication is two way
Example	Radio/ TV broadcast	telephone