MODEL ANSWER

SUMMER– 17 EXAMINATION

Subject Title: Communication Techniques

17438

Subject Code:

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.

1. (A) Attempt any SIX of the following : **12**

(a) Compare AM and FM (any four points).

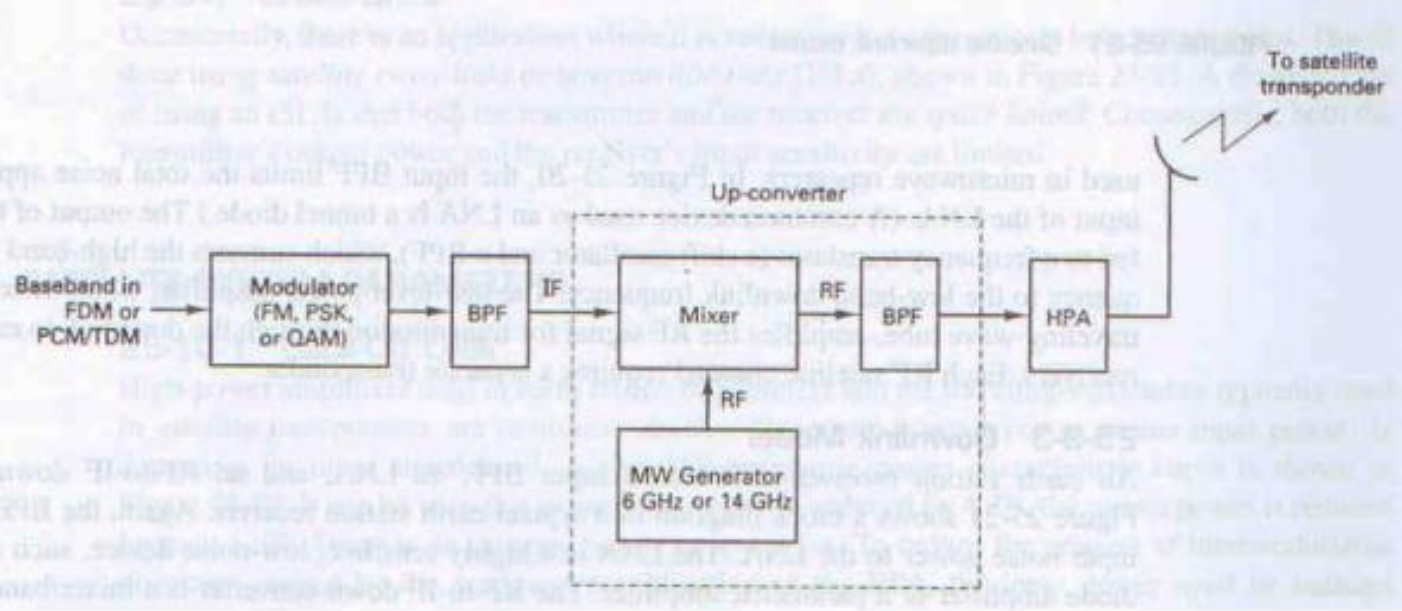
ANS: (Each 1M)

Parameters	AM	FM
Sidebands	Two	Infinite
Bandwidth	2 Fm	2(δ+Fm)
Noise Immunity	Low	High
Transmission frequencies used	540 – 1650 KHz	88-110 MHz

(b) Drawn uplink and downlink model. Mention uplink and downlink frequencies used in satellite.

ANS:(Each model - 1M, Frequencies for each- 1M)

Uplink model :



Downlink model:

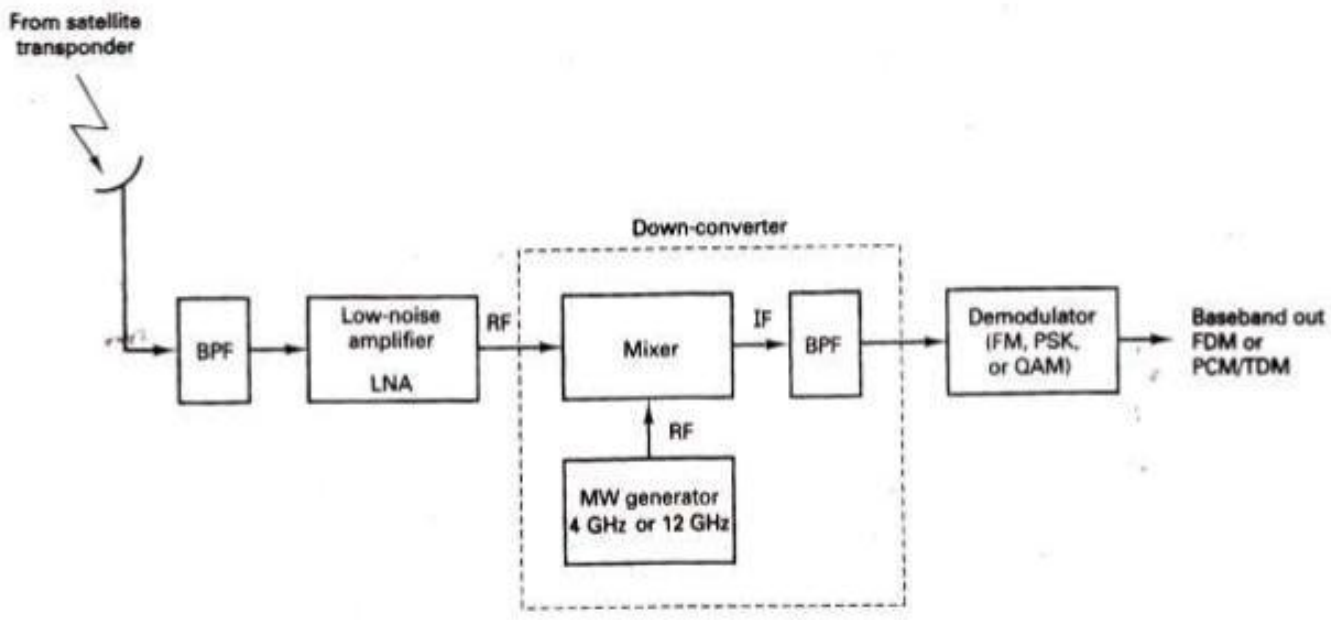


Fig. Satellite downlink model

Uplink frequency:- The signal to be transmitted such as telephone signal is converted to another signal having a particular microwave frequency by the transmitter in the earth station.
This signal is then transmitted up towards the satellite therefore the frequency of signal transmitted from earth station to satellite is called as uplink frequency .The uplink frequency is generally higher than corresponding downlink frequency. The range of uplink frequency is **6 GHz for c band**.
Downlink frequency- The satellite receive signal coming from earth station and amplifies it, changes its frequency and radiates back to the earth. The frequency of signal transmitted from satellite towards the earth is called as downlink frequency. Uplink and downlink frequencies are different from each other to avoid interference .The range of downlink frequency is **4 GHz for c band**.

(c) List any four types of digital modulation techniques.

ANS: (Each 1/2M)

Types of modulation techniques are (any 4)

i) ASK (Amplitude Shift Keying).
ii) FSK (Frequency Shift Keying).
iii) PSK (Phase Shift Keying).
iv) QPSK (Quadrature Phase Shift Keying).

v) BPSK (Binary Phase Shift Keying).
vi) DPSK (Differential Phase Shift Keying).

(d) Name network devices one each, which operates at physical level, data link layer, network layer, application layer.

ANS: (Each- 1/2M)

Physical Layer: Router, Hub, Bridge, NIC.

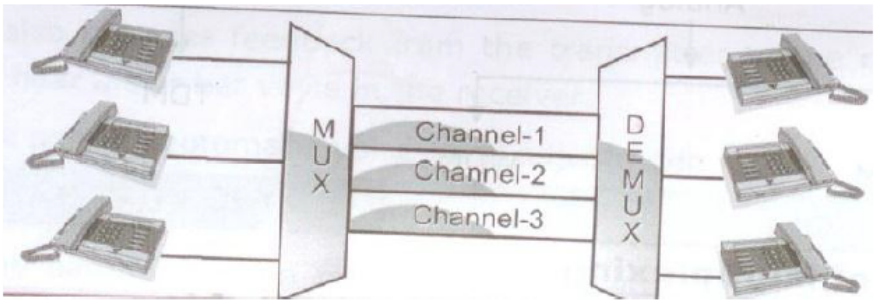
Data link Layer: Repeater, Bridges and Router.

Network Layer: Hub, Switches and router.

Application Layer: Data load balancers Fire walls and computers.

(e) What is FDM? Where it is used?

ANS: (FDM- efinition-1 mks, diagram-2 mks, application any two – 1mks)



Explanation-FDM means total range of frequency is divided into number of frequency slots. Each slots of frequency is allotted to each channel. Various channels of different frequencies combined, transmitted through single wire and separated at receiver with the help of De-multiplexer. FDM can be applied when the bandwidth of the link is greater than the combined BW of the signal to be transmitted. These modulated signals are than combined into a single composite signal that can be transported by the links. Carrier frequency is separated by sufficient BW to accommodate the modulated signal .These BW range are the channel through which the various signals travels. Channels must be separated by guard bands to prevent signals from overlapping.

Applications- 1) Telephone exchange
2) Mobile communication
3) Satellite communication

(f) List different frequency bands with their frequency ranges in electromagnetic spectrum.

ANS: (Any four- Each 1 Mks)

Different frequency bonds with their frequency ranges:

Sr. No.	Frequency Bond
1	ELF-300 Hz - 3 KHz
2	VLF – 3 KHz-30 KHz
3	LF – 30 KHz- 300 KHz
4	MF – 300 KHz – 3 MHz
5	HF – 3 MHz – 30 MHz
6	VHF – 30 MHz – 300 MHz
7	UHF – 300 MHz – 3 GHz
8	SHF – 3 GHz – 30 GHz
9	EHF – 30GHz – 300 GHz

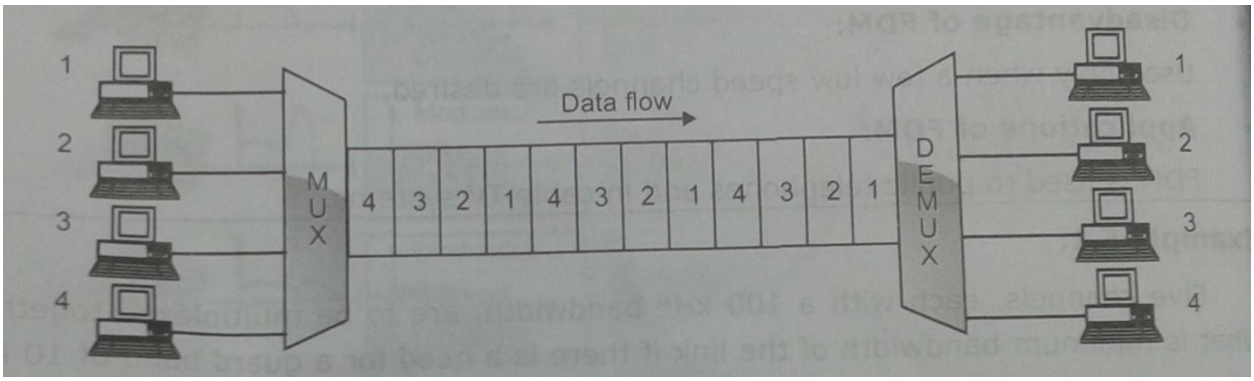
(g) State working principal of TDM and its any one application.

ANS: (Working 2M, diagram- 1 mks, Application-1 M)

TDM is digital multiplexing technique to combine data. It is a process that allows several connections to share the high bandwidth of a link. Instead of sharing a portion of the bandwidths as in FDM, time is shared in TDM.

Various channels having different time slots combined in a single wire and at the receiver they are separated with the help of demultiplexer.

Figure:



Applications of TDM; Any one

i) In ISDN telephone lines.
ii) In wire line telephone system

(h) State the function of transponder in satellite communication.

ANS: (Function- 4mks)

A transponder takes the received signal from uplink antenna, amplifies it, down converts frequency, and retransmit to ground station receivers.

(B) Attempt any TWO: **8**

(a) State sampling theorem. Give the difference between natural and flat top sampling.

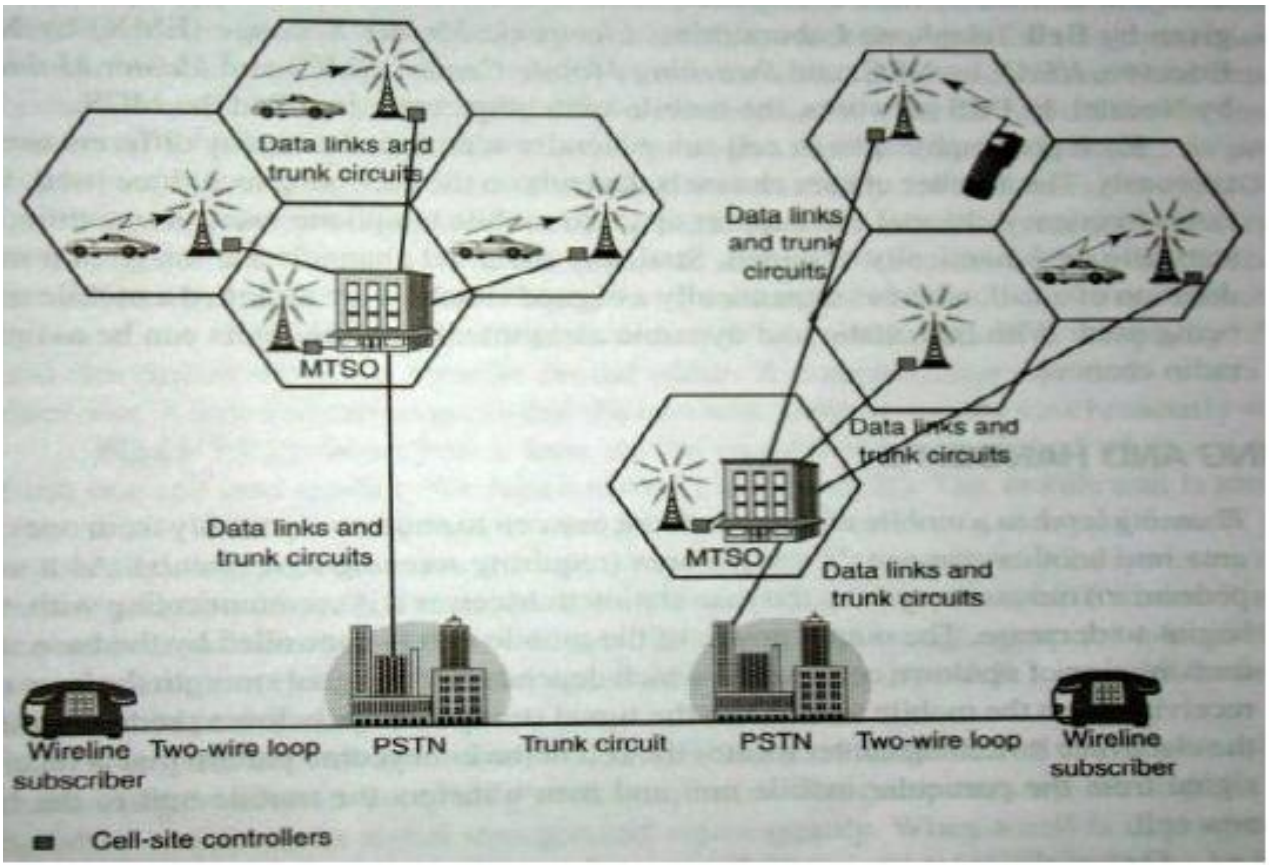
ANS: (definition- 2 mks, Difference any two-2M)

Sampling theorem:- A continuous time signal x(t) can be completely represented in its sampled form at the transmitter and recovered back from its sampled form at receiver(with minimum distortion) if the sampling frequency fs≥2w.

Sr. No.	Parameters	Natural Sampling	Flat –top Sampling
1	Circuit arrangement	Chopper circuit	Sample and hold circuit
2	Sampling rate	Satisfies Nyquist criteria	Satisfies Nyquist criteria
3	Signal power	Increases with increase in pulse width	Increases with increase in pulse width
4	Band width requirement	Increase with reduction in pulse width	Increase with reduction in pulse width

(b) Draw and explain block diagram of cellular mobile phone.

ANS: (Diagram 2M , Explanation 2M)



Explanation:-Fig shows a mobile or cellular telephone system that includes all the basic components necessary for mobile communication. The radio network is defined by a set of radio frequency transceiver located within each of the cells. The location of these radio frequency transceivers are called base station Base station: base station serves as central control for all users within that cell.
Mobile unit communicate directly with the base stations & the base stations communicate directly with a mobile .Telephone switching office (MTSO):-An MTSO controls channel assignment, call processing, call setup & call termination which includes signaling switching, supervision & allocating radio-frequency channels. The MTSO provides a centralizes administration &maintenance point for the entire network & interfaces with the public telephone network over wire line voice trunks & data links.

(c) Define bit, frame, packet and segments. Write the one of OSI layer which uses these entities.

ANS: (Each Definition -1/2M, naming OSI layer- ½ mks each)

Bit: The bit is a basic unit of information in computing and digital communication. A bit can have only one of two values , and may therefore be physically implemental with a two state

device. These values are most commonly represented as either a 0 or 1. The term bit is a portmanteau of binary digit.

Frame: Physical layer representation is called frame.

Packet: It is a more generic term used either transport layer or network layer.

Segments: It is the transport protocol is TCP the unit of data sent from TCP to network layer is called segments.

Function of each Layer:
1. **Physical Layer** : To transmit bits over medium. To provide electrical and mechanical Specifications.
2. **Data Link Layer**: To organize bits to frame .To provide hop to hop delivery.
3. **Network Layer**: To move packets from source to destination .To provide internetworking.
4. **Transport Layer**: To provide reliable process to process message delivery and error recovery
5. **Session Layer**: To establish manage and terminate session.
6. **Presentation Layer**: To translate encrypt and compress data
7. **Application Layer** : To allow access to network resources

2. Attempt any FOUR : 16

(a) State the meaning of the terms :

(i) Data rate
(ii) Bite rate
(iii) Baud rate
(iv) Channel band width.

ANS: (Each definition- 1M)

i) **Data rate:** Data rate means how fast we can send data, in bits per second, over a channel.Data rate depends on three factors:
- The bandwidth available.
- The levels of the signals we can use.
- The quality of the channel (i.e. the level of noise)

Two formulas are developed to calculate the data rate: one by Nyquist for a noiseless channel, another by Shannon for a noisy channel.

ii) **Bite rate:** Bit rare is the number of bits transmitted per second.
Data rate is also known as bit rate.

$$Bit\ rate = \frac{1}{Bit\ interval}$$

As shown in figure, if the bit duration is T_b(known as bit interval), then bit rate will be $\frac{1}{Tb}$.

i.e. bit rate should be as high as possible.

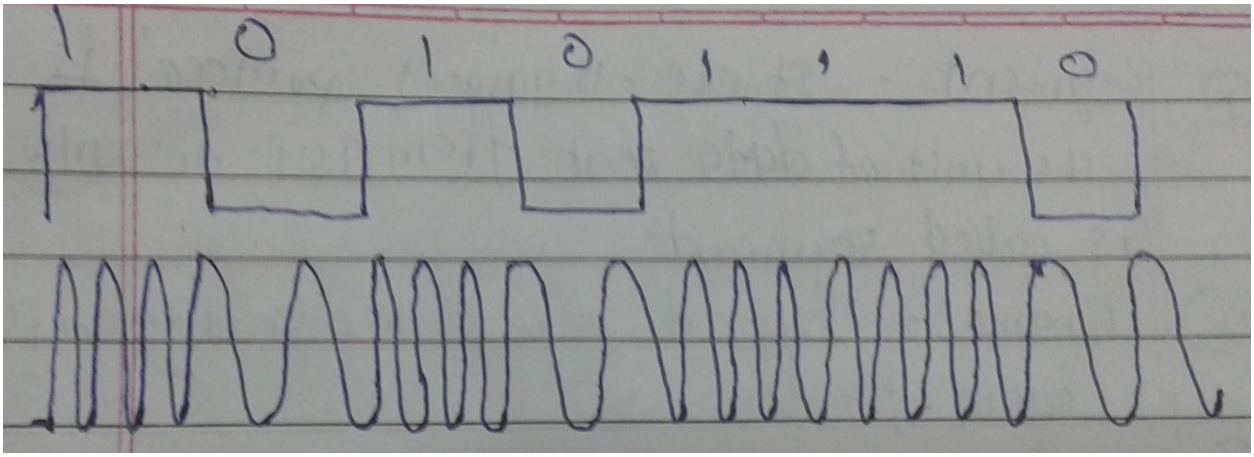
With increase in data rate the bandwidth of transmission medium must be increase in order to transmit the signal without any distortion.

iii) **Baud rate:** Baud rate is the number of signal units per second.
Note that Baud rate is less than or equal to the bit rate.
Baud is the unit of signaling speed or modulation rate or rate of symbol transmission.

iv) Channel bandwidth:
The range of frequencies that a medium (or channel) can pass is called channel bandwidth. Because no medium can pass or block all frequencies that a medium can pass without losing one-half of the power continued in that signal.
For example, if a medium can pass frequencies between 1000 to 5000 without losing most of power contained in this range, its bandwidth is 5000- 1000 = 4000.
The bandwidth is the difference between the highest and lowest frequencies that the medium can satisfactorily pass.

b) Draw FSK waveform for a given bit sequence 10101110. State its advantages and disadvantages over ASK.

ANS: (Diagram -2M, advantages- any one- 1 m, disadvantage- any one- 1M)



Advantages of FSK:

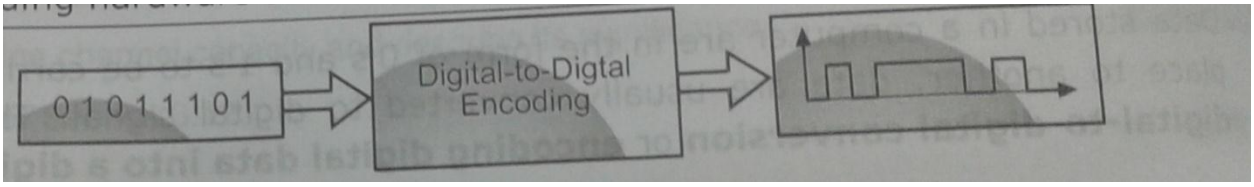
i) Easy to implement.
ii) Better noise immunity than ASK.

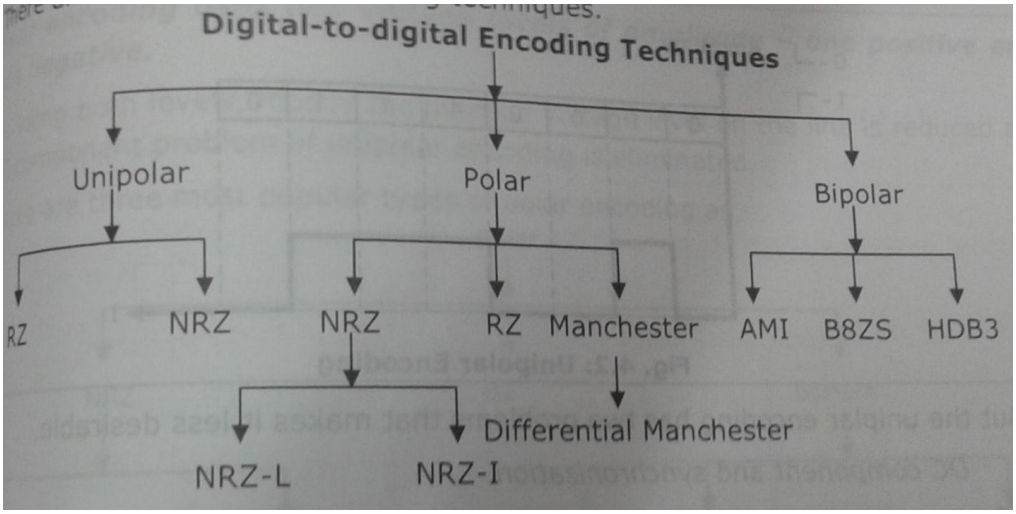
Disadvantages of FSK:

I. Not useful for high speed modems.
II. Preferred only for low speed modems.

c) What are the types of digital to digital encoding? How encoding differs from modulation?

ANS: (types 2M, difference- any two- 2M)

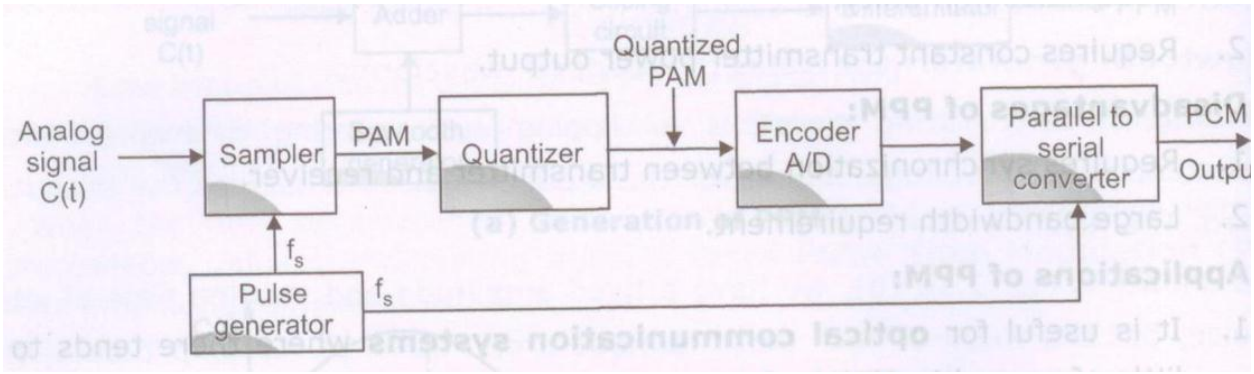




Parameters	Encoding	Modulation
1 Definition	Encoding is the representation of digital information by a digital signal.	Low frequency signal is superimposed on high frequency signal.
2 Input	Input is in the form of 1's and 0's converts into corresponding voltage levels.	Input is analog signal and carrier that results in modulated signal.
3 carrier	Not required.	Required.

d) Draw the block diagram of PCM transmitter. Explain the function of each block.

ANS: (diagram 2M, explanation 2M)



Working principle of PCM:-

The analog signal x (t) is passed through a band limiting low pass filter, which has a cut-off frequency fc =W Hz. This will ensure that x (t) will not have any frequency component higher than "W". This will eliminate the possibility of aliasing.
The band limited analog signal is then applied to a sample and hold the circuit where it is sampled at adequately high sampling rate. Output of sample and hold block is a flat topped PAM signal.
These samples are then subjected to the operation called "Quantization" in the "Quantizer". The quantization is used to reduce the effect of noise. The combined effect of sampling and quantization produces the quantized PAM at the quantizer output.
The quantized PAM pulses are applied to an encoder which is basically an A to D converter. Each quantized level is converted into an N bit digital word by the A to D converter. The value of N can be 8,16,32,64 etc. The encoder output is converted into a stream of pulses by the parallel to serial converter block. Thus at the PCM transmitter output we get a train of digital pulses.

e) A broadcast transmitter radiates 50kW of carrier power. What will be the radiated power at 85 percent modulation?

ANS: (proper solution in steps-4M)

Pc= 50kW, m= 0.85 i.e. 85%

$$Pt = Pc\left(1 + \frac{m^2}{2}\right)$$

$$Pt = 50\left(1 + \frac{0.85^2}{2}\right)$$

$$Pt = 50\left(1 + \frac{0.7225}{2}\right)$$

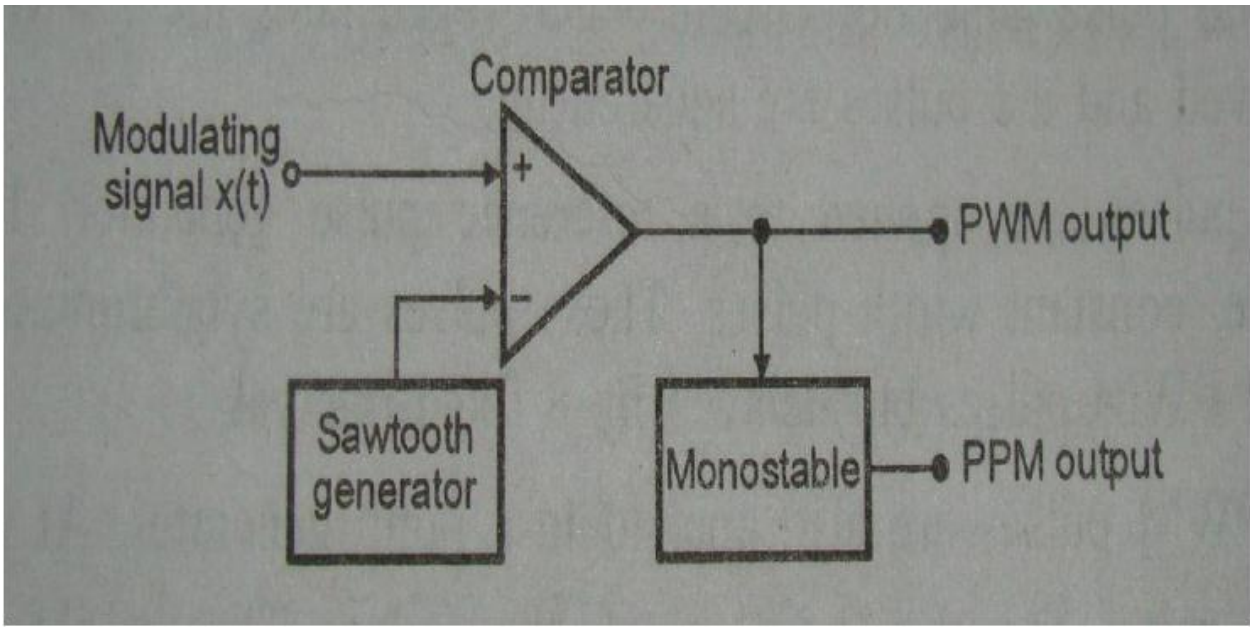
$$Pt = 50(1 + 0.361)$$

$$Pt = 50(1.361)$$

$$Pt = 68.06kW$$

f) Explain PWM generation with its waveform.

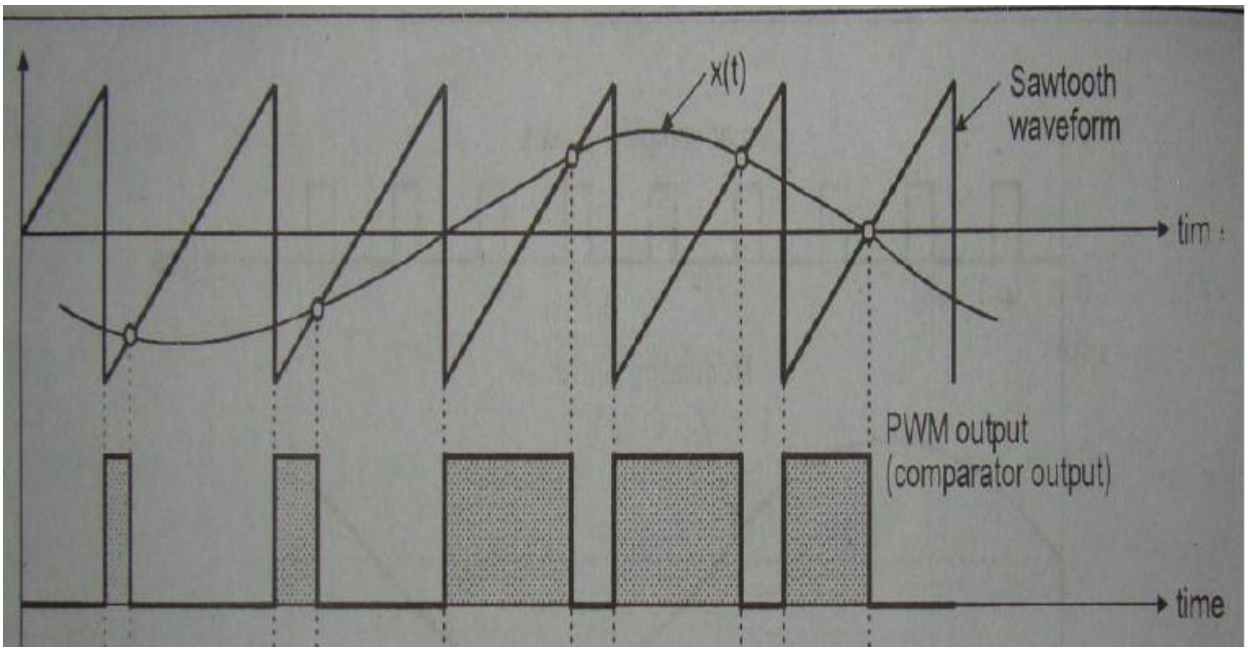
ANS: (Diagram- 2 mks, Explanation 1M, waveform 1M)



Explanation-

The block diagram of above fig. can be used for the generation of PWM as well as PPM.A saw tooth generates a saw tooth signal frequency fs, therefore the saw tooth signal in this case is a sampling signal. It is applied to the inverting terminal of the same comparator.

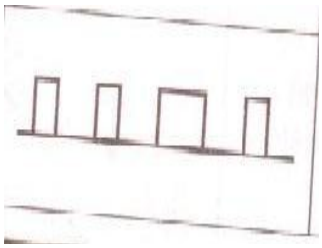
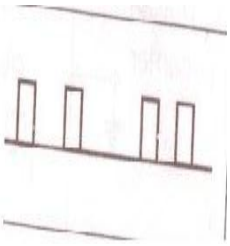
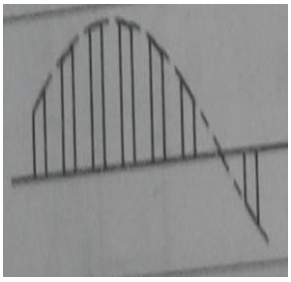
The modulating signal x(t) is applied to the non-inverting terminal of the same comparator. The comparator output will remain high as long as the instantaneous amplitude of x(t) is higher than that of the ramp signal. This gives rise to a PWM signal at the comparator output as shown in waveform below.



3. Attempt any FOUR :

(a) Compare PAM, PWM and PPM.(4 points)

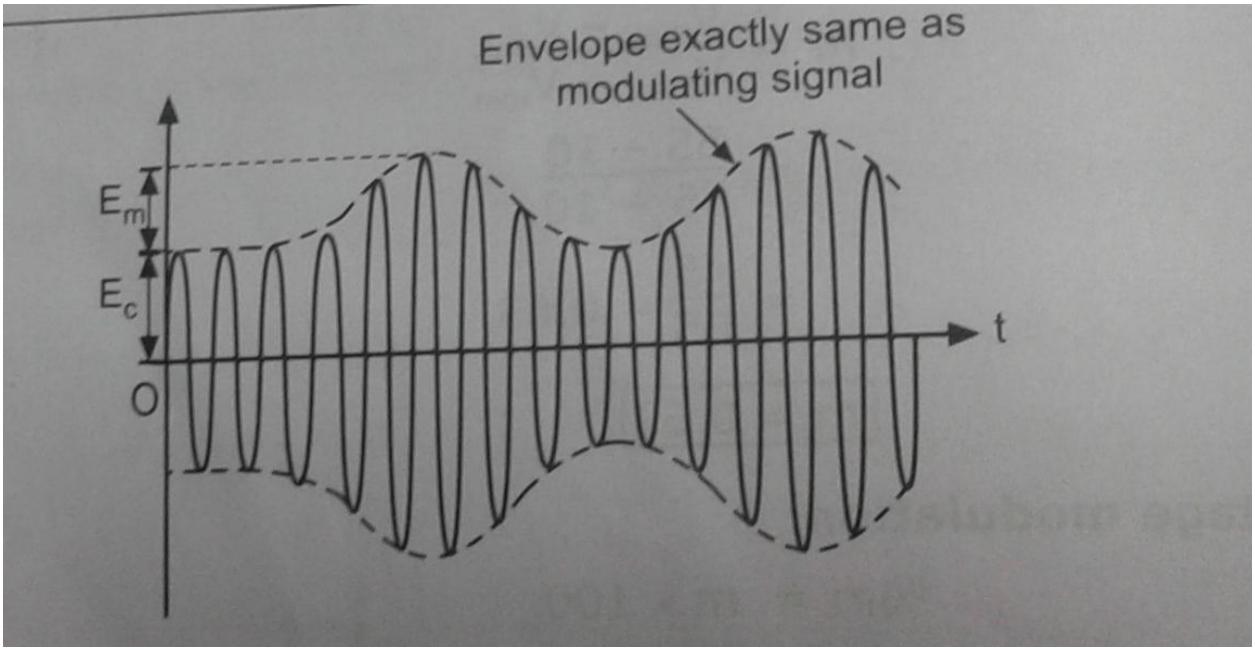
ANS: (Any four points-Each 1M)

PARAMETER	PWM	PPM	PAM
(i)Transmitted power	Varies with variation in width	Remains constant	Varies with amplitude of pulses
(ii) Bandwidth requirement	High	High	Low
(iii)Output waveform			
(iv) Variable parameter of carrier	Width of carrier pulse	position of carrier pulse	Amplitude of carrier pulse
(v) Noise immunity	High	High	Low
(vi)Information contained in	Width variations	Position variations	Amplitude variations

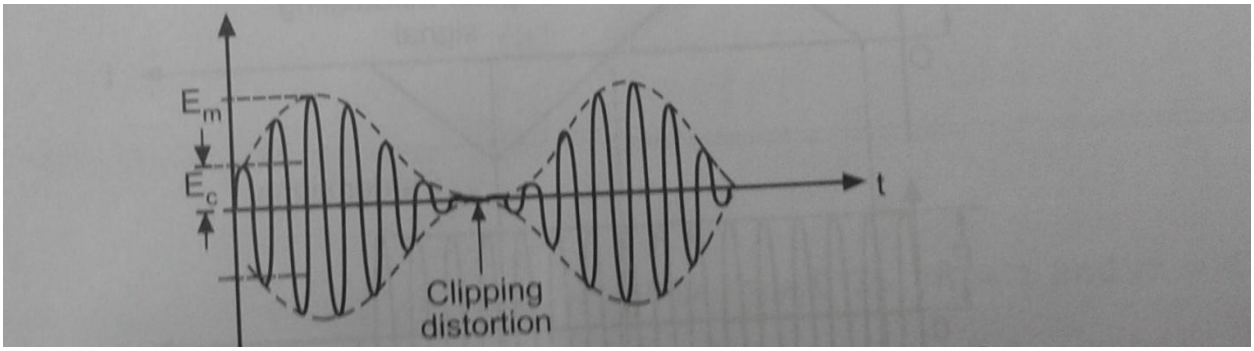
(b) Draw AM waveforms for under modulation, over modulation and 100% modulation.

ANS: (each answer 1 mks(conceptual), 1mks for neatness)

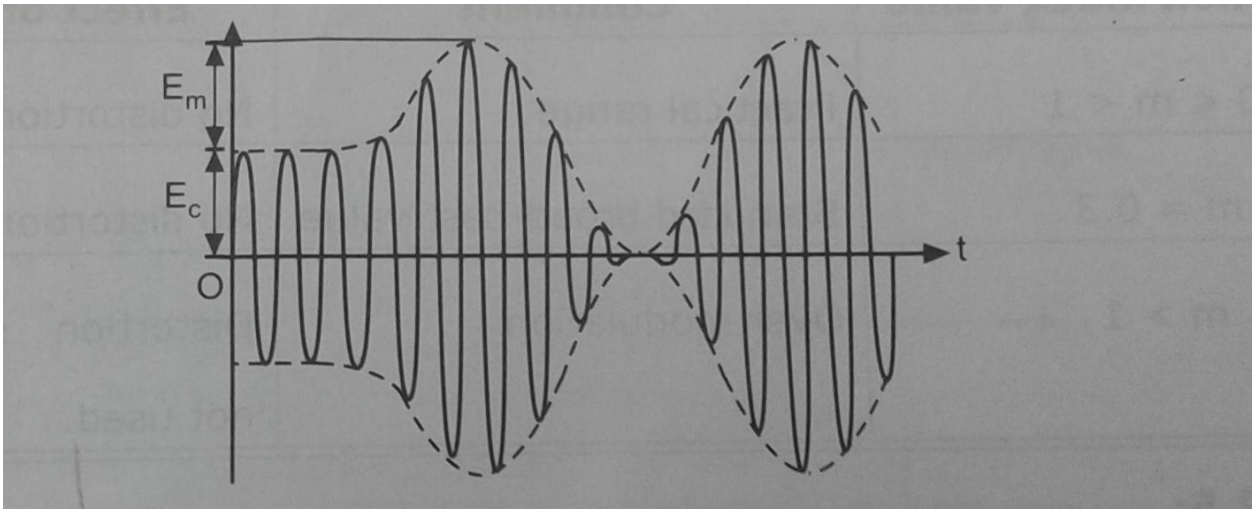
AM waveform under modulation:



AM waveform over modulation:



AM waveform 100% modulation:



(c) Describe the working principle of CDMA with neat diagram.

ANS:(Principle 2M, diagram2M)

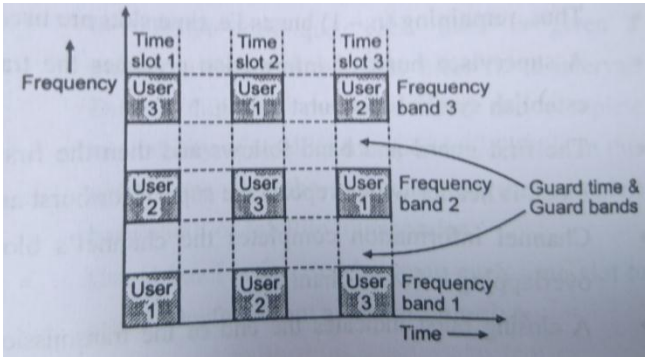
Suppose in a room, everyone is talking at ones, then nothing can be understood. But if everyone is talking in different language, then they can be understood. Like this, CDMA has no channels but instead, every call is encoded by adding code (called pseudo-noise code) that makes it different from other calls in frequency spectrum.

CDMA is a spread spectrum technique where multiple signals occupying the same RF bandwidth are to be transmitted simultaneously without interfering to one another.

CDMA is shares both frequency and time shown in figure.

As shown in figure, CDMA has wide baud so it accommodate more users in continuous time basis.

Figure:



(d) What is DPSK? State its principle. Draw the block diagram to generate DPSK.

ANS: (DPSK- 1 MKS, PRrinciple- 1 mks, block diagram- 2 mks)

DPSK- Differential phase shift keying (DPSK)is differentially coherent modulation method. DPSK does not need a synchronous (coherent) carrier at the demodulator. The input sequence of the binary bit is modified such that the next bit depends upon the previous bit. Therefore in the receiver the previous received bit are used to detect the present bit. The differential phase shift keying (DPSK) is a modification of BPSK.

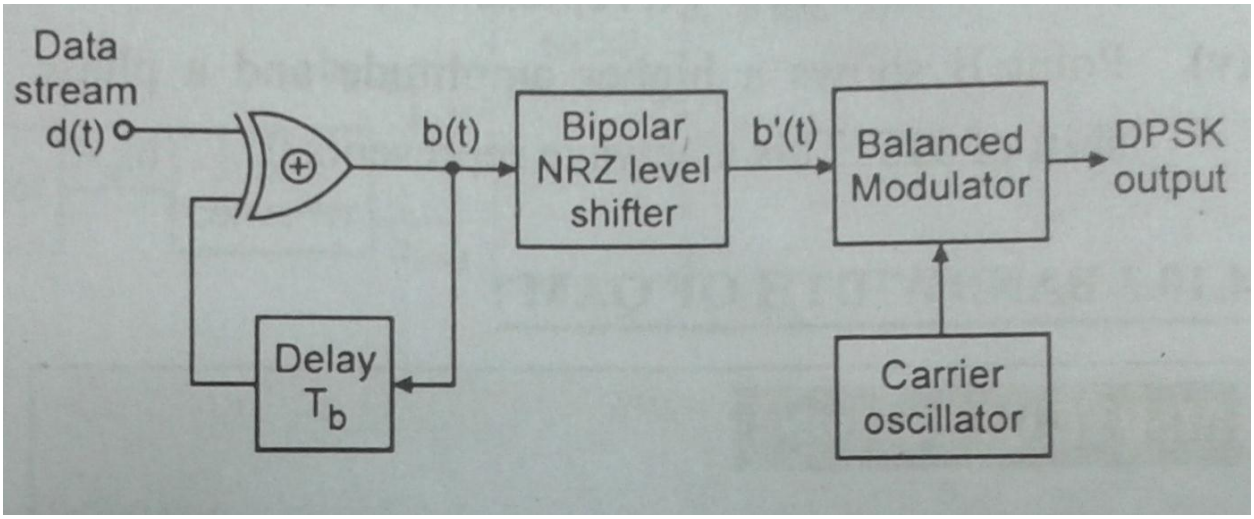
Principle-The differential phase shift key can be treated as the non-coherent version of PSK. It combines two basic operations namely 1) The different encoding and 2) Phase shift keying.

Hence the name differential phase shift keying (DPSK). In the BPSK receiver the process of carrier recovery begin by squaring the received BPSK signal$\sqrt{2Ps}\, b(t)\cos(\omega ct + \theta)$.

Even if the received signal is –b(t). $\sqrt{2Ps}\cos(\omega ct + \theta)$, the squared signal will remain same. Therefore we shall not to be able to determine whether the receiver signal is transmitted signal b(t) or its negative –b(t). In this type phase reversal takes place when the signal passes through the telephone and switching networks. Differential PSK i.e. DPSK will eliminate this ambiguity about whether the received data was inverted or not. Another advantages of DPSK is that it does not required synchronous carrier at the demodulator for its detection.

Figure shows the block diagram of DPSK generator.

Figure:

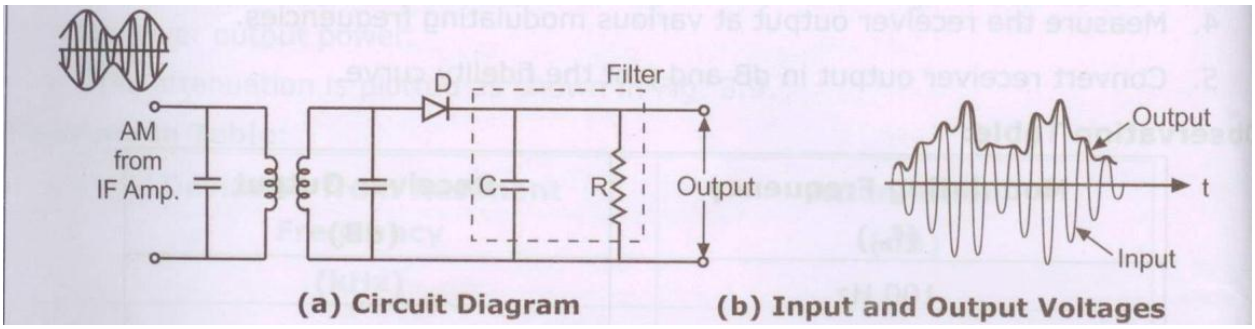


(e) What is demodulation? Explain AM demodulation by diode detector.

ANS: (Definition- 1 mks, diagram- 2 mks, explanation- 1 mks)

Demodulation: Extracting the original information signal from the modulated signal is called demodulation.

AM Diode demodulator-



Explanation-
The diode is the most common device used for AM demodulation. The simple diode detector is shown in figure. AM signal is applied to input of the simple detector. In every positive half cycle diode is in forward bias so that capacitor charges to peak the value of input voltage. As soon as input voltage goes below peak point voltage diode will reverse bias and capacitor discharges through R.

Charging and discharging of capacitor repeats for each cycle that results in positive envelope of AM signal appear at output as shown in figure . This envelop is nothing but original modulating signal.

(f) Explain (i) Tele-surgery (ii) Tele dermatology.

ANS: (each in brief- 2M)

Telesurgery- **(2 mks)**

Telesurgery does not exactly means doing surgery remotely .It is classified into two categories namely telemetering &telepresence .In telemetering surgeon present near patient performs surgery in consultation with distant specialist & expert surgeon .telemetering is also used for trading to student remotely who can observe surgery remotely .Telepresence surgeryused to perform micro procedure such as vascular repair & laser retinal surgery

Tele-dermatology- **(2 mks)**

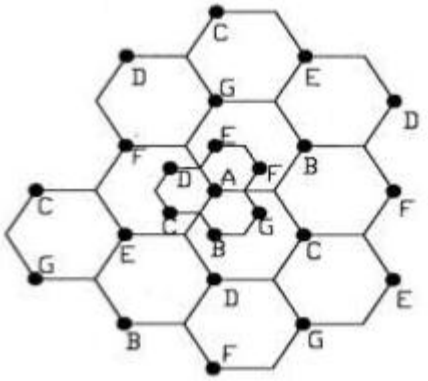
Tele dermatology is delivery of dermatologic patient care through telemedicine technologies. The dermatologist uses telecommunication equipments to evaluate clinical and laboratory data as well as diagnose and prescribe therapy for patients located at different location .Its goal is to reach underprivileged and provide services to them. It is categorized in real-time & store and forward Teledermatology.

4. Attempt any FOUR: 16

(a) Define cell splitting and state its need.

ANS: (Definition- 2 mks, any two need- 2 mks, diagram- optional –1 mks can be given)

The process of subdividing of the congested cell into smaller cells by reducing the antenna height and transmitted power is called as cell splitting. The cell splitting increases the co-channeled interference ratio reducing the interference. The channel capacity of the cells increases accordingly. The antenna height is reduced.



Need

1. To improve the capacity of cell
2. To increase the coverage area

(b) State various handoff techniques used in mobile communication and explain any one.

ANS: (list any four – 2 mks, explain any one – 2 mks)

Types of handoff techniques-

i)Signal strength hand-off

ii) C/I hand-off.

iii) Power difference hand-off.

iv) mobile assisted hand-off.

v) hard hand-off

vi) soft hand-off

vii) Delayed hand-off

viii) Queued hand-off

ix) forced hand-off

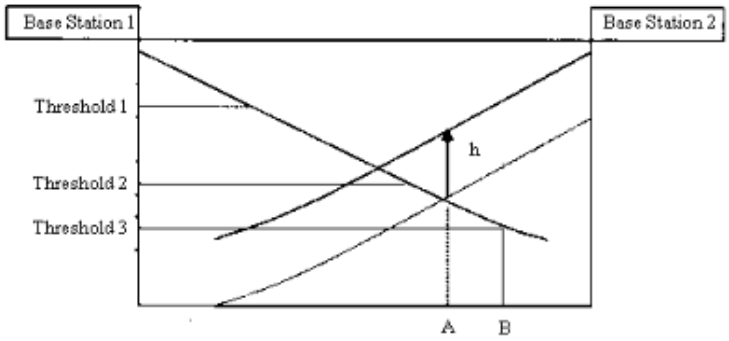
x) Cell site hand-off

xi) Inter-system hand off.

In many situations, instead of one level two level handoff procedure is used. Handoff is requested after certain delay of time. It can be delayed if no available cell could take the call.

When the signal drops below the first handoff level request is initiated. If due to some reason the neighboring cell is busy handoff requested after 5sec.If the signal strength becomes lower and reaches second hand off level then hand off will take place. A handoff could be delayed if no available cell could take the call or the neighboring cells are busy.

Operation termed as Delayed Handoff.



(c) Explain the principle of operation of hubs, repeaters, bridges and routers.

ANS: (function of each 1M)

i) **Hub**- Hub is amplifying & splitting device .Hub contains multiple ports & is a common connection point for connecting all segments of a LAN. When a packet arrives on a port, it is forwarded to rest of ports so that it can be sent to all other nodes in the network.

ii) **Repeater**- Repeaters -As signals travel along a cable, they degrade and become distorted in a process called "attenuation." If a cable is long enough, attenuation will finally make a signal unrecognizable. Installing a repeater enables signals to travel farther. A repeater is a physical layer device. It receives, amplifies (regenerates), and retransmits signals in both directions.

iii) **Router:-** It is used to connect computer or severs to internet or two or more networks such as LAN.MAN or WAN or its ISPs. It is combination of hardware and software.

iv)Bridges-Are network devices used to connect two similar devices.

A device that connects two local-area networks (LANs), or two segments of the same LAN. The two LANs being connected can be alike or dissimilar. For example, a bridge can connect an Ethernet with a Token-Ring network. Unlike routers, bridges are protocol -independent. They simply forward packets without analyzing and re-routing messages. Consequently, they're faster than routers, but also less versatile

(d) What is network security? Explain with examples.

ANS: (Network security- 2 mks, Any one example- 2 mks)

Network security is the security provided to a network from unauthorized access and risks. It is the duty of network administrators to adopt preventive measures to protect their networks from potential security threats. Computer networks that are involved in regular transactions and communication within the government, individuals, or business require security. The most common and simple way of protecting a network resource is by assigning it a unique name and a corresponding password.

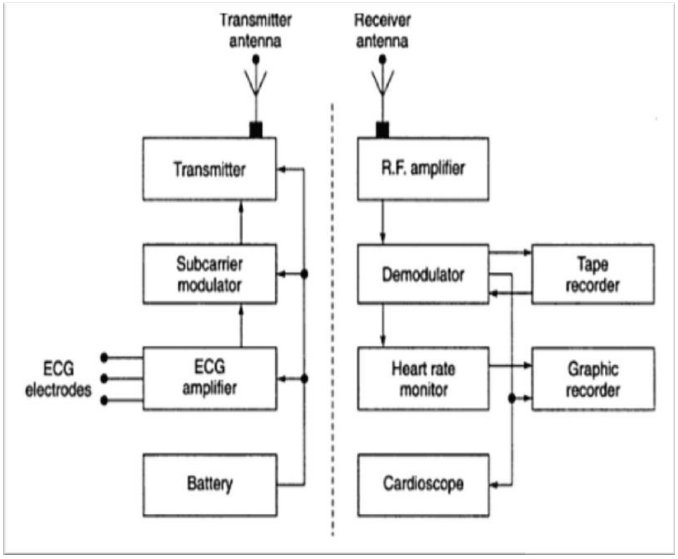
Types of Network Security Devices-

Active Devices
Passive Devices
Preventative Devices
Unified Threat Management (UTM)

Firewalls: A firewall is a network security system that manages and regulates the network traffic based on some protocols. A firewall establishes a barrier between a trusted internal network and the internet. Firewalls exist both as software that run on a hardware and as hardware appliances. Firewalls that are hardware-based also provide other functions like acting as a DHCP server for that network. Most personal computers use software-based firewalls to secure data from threats from the internet. Many routers that pass data between networks contain firewall components and conversely, many firewalls can perform basic routing functions. Firewalls are commonly used in private networks or *intranets* to prevent unauthorized access from the internet. Every message entering or leaving the intranet goes through the firewall to be examined for security measures.An ideal firewall configuration consists of both hardware and software based devices. A firewall also helps in providing remote access to a private network through secure authentication certificates and logins.

(e) Draw block diagram of single channel biotelemetry system for ECG and briefly explain its operation.

ANS: (diagram 2M, explanation 2M)



Description-It consist of mainly two parts namely telemetry transmitter & telemetry receiver.

Transmitter: - Signals picked up by pre gelled electrodes are amplified & modulated at frequency of 1 KHz. It is again modulated to UHF frequency. The resulting signal is radiated with of electrode lead (RL) which works as antenna.

Receiver:– it uses unidirectional quarter wave monopole receiving antenna which receives signals .These signals are in turn fed to RF amplifier RF amplifier which performs RF filtering &image frequency rejection & it prevents cross coupling .The output of RF amplifier is fed to demodulator .demodulator demodulates signal & it is provided to ECG filter

(f) **What is internet based medical services? Give ethical and legal aspects of it**.

Ans:- (internet based medical services- 2 mks, ethical and legal aspects-any 4 points- 2 mks)

The Internet is transforming the present and future of health care. For example, the Internet enables anyone to learn about medical conditions and treatments at home, communicate with their doctors via email even provide vital data to doctors through monitoring devices that connect to the computer and transmit information right from the body. Such net-based technologies, allowing detailed virtual interactions between physicians and patients, are more important than ever today, since an increasing number of senior citizens live at home, for longer periods (thanks in part to medical alert systems that allow seniors to enjoy 24/7 protection at the press of a button, in case of a health emergency). The benefits of the Internet, and the medium supports health care industry to improve patient self-management, patient satisfaction, and health outcomes.

Ethical and legal aspects- The healthcare industry appears to be avoiding use of email and Web marketing as a result of concerns regarding restrictions and warnings from insurers not to engage in electronic communication with consumers.

1.It should ensure the confidentiality, integrity, and availability of all electronic protected health information the covered entity creates, receives, maintains, or transmits.

2) Protect against any reasonably anticipated threats or hazards to the security or integrity of such information.

3) Protect against any reasonably anticipated uses or disclosures of such information that are not

permitted or required .

4) Ensure compliance with this subpart by its workforce.

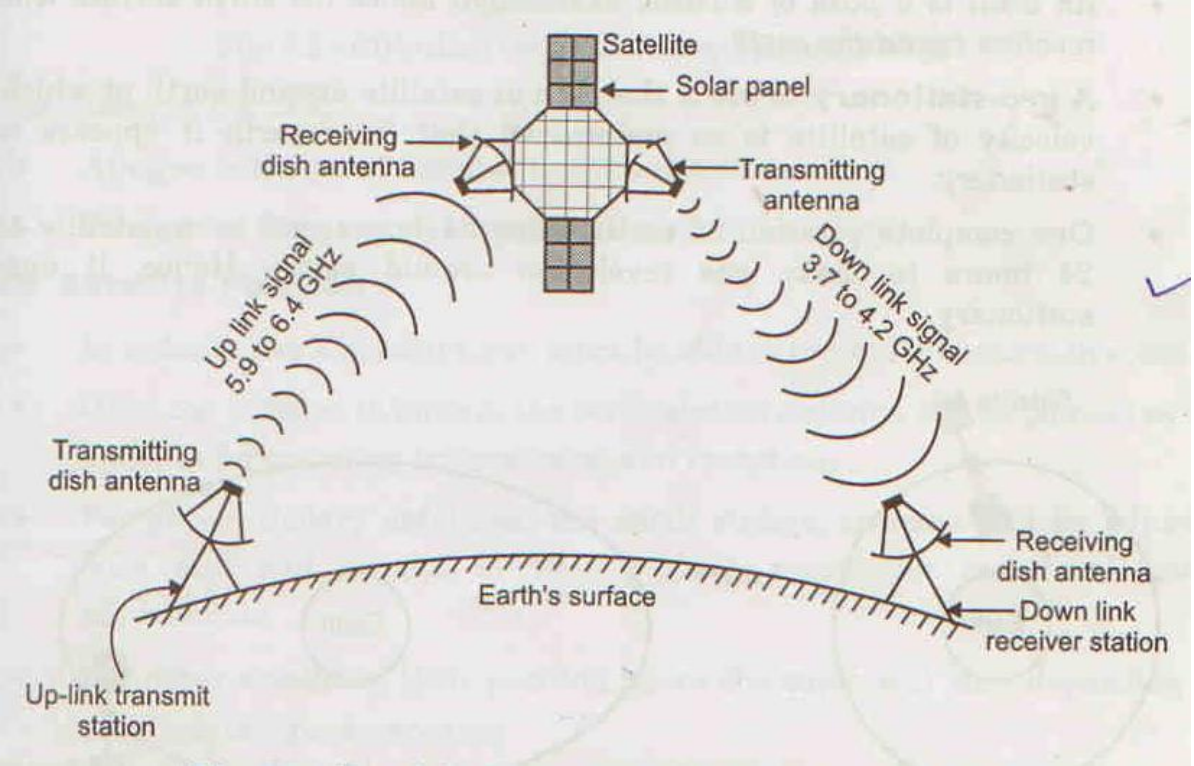
5) Marketers must do no harm.

6) Marketers must foster truth and trust in the marketing system.

5. Attempt any FOUR: 16

(a) Draw block diagram of satellite communication system and explain it.

ANS: : (diagram 2M, explanation 2M)



Explanation-In satellite communication, signal transferring between the sender and receiver is done with the help of satellite. In this process, the signal which is basically a beam of modulated microwaves is sent towards the satellite. Then the satellite amplifies the signal and sent it back to the receiver's antenna present on the earth's surface. So, all the signal transferring is happening in space. Thus this type of communication is known as space communication. Satellite

communication**,** in telecommunications, the use of artificial satellites to provide communication links between various points on Earth. Satellite communications play a vital role in the global telecommunications system. Approximately 2,000 artificial satellites orbiting Earth relay analog and digital signals carrying voice, video, and data to and from one or many locations worldwide.

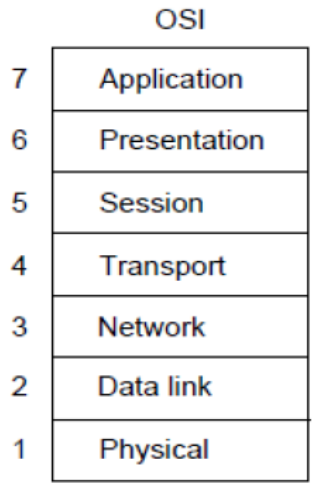
Frequency Band (optional- 1 mks can be given)

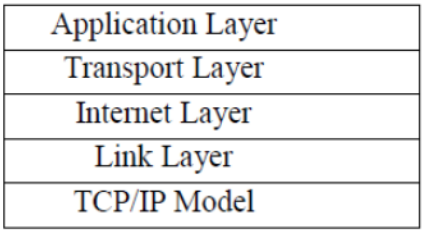
1. X-Band
2. Ku-Band
3. Ka-Band (Commercial)
4. Ka-Band (Military)

(b) Draw architecture of OSI and TCP/IP model. Why TCP/IP is preferred in network system?

ANS: (Both architecture-1 mks each, TCP/IP preferred- 2 mks)

TCP/IP





TCP/IP is preferred-

TCP/IP provides end to end connectivity specifying how data should be packetized, addressed, transmitted, routed and received at destination. This functionally is organized into four abstraction layer which are used to sort all related protocols according to scope of networking involved.

(c) Explain varies modes of data transmission.

ANS:(proper explanation- 4 mks)

Different types of data transmission modes are as follows:

a) Serial transmission (synchronous, asynchronous, isochronous)

b) Parallel transmission

OR

1. Simplex mode
2. Half-duplex mode
3. Full-duplex mode

Synchronous mode	**Asynchronous Mode**
faster	Slower comparing with synchronous communication
Costlier comparing with asynchronous communication	cheaper
No start stop bit	Start stop bit required in each payload (data units)
synchronization required	No synchronization required

(d) Compare star and ring topology with respect to :

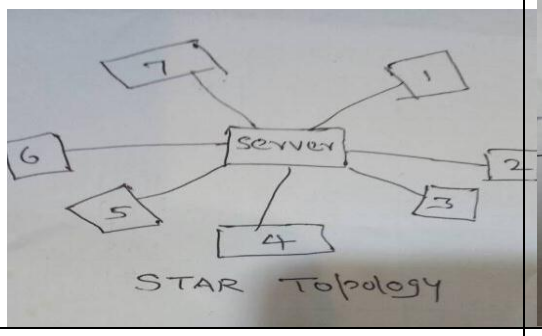
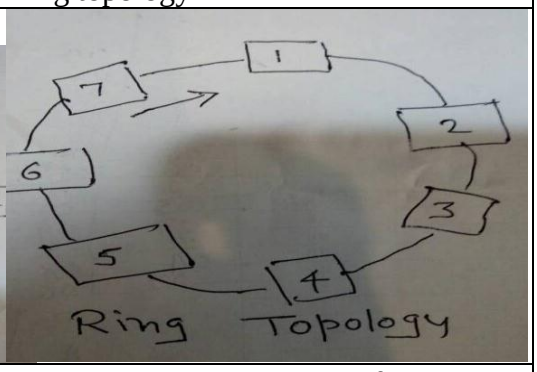
(i) Arrangements of nodes

(ii) Unit used for data transmission

(iii) Ease to installation

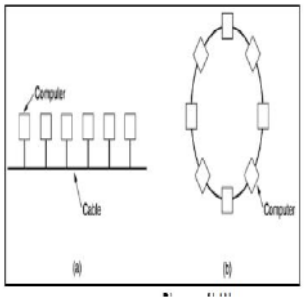
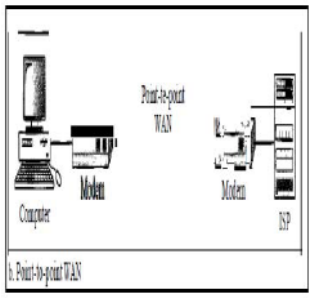
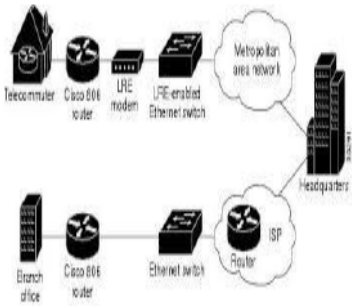
(iv) Maintenance

ANS:

Parameters	Star topology	Ring topology
Node arrangement		
Ease to installation	Ease to installation and reconfiguration	Not easy to install and reconfiguration
Maintenance	Ease to detected the fault and maintenance	Difficult for troubleshooting the ring and maintenance.
Unit for data transmission	pending	

(e) Compare LAN, WAN and MAN.(4 points)

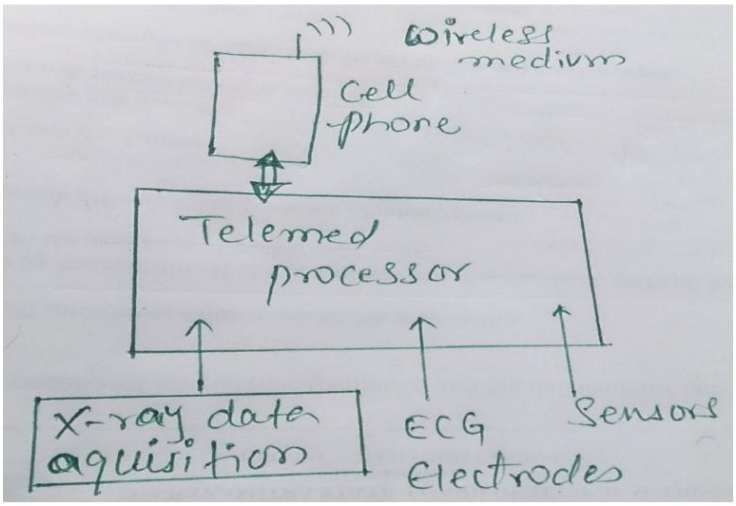
ANS: (Relevant four points- each 1M)

Criteria	LAN	WAN	MAN
Extend of geographical area	LAN is network within a single building or campus of up to 1 kilometer.	WAN is network within countries or continent building or campus of up to few kilometers.	MAN is network within a single city or town up to 10 kilometers.
Basic structure diagram			
Speed	Highest Speed of operation Up to GBPS in some LAN Technology	Lowest Speed of Operation Range between Kbps to Few MBPs, WAN speed varies based on geographical location of the servers.	MAN network has lower speed compared to LAN.
Application	For small scale application like Home ,office, School Network	For long distance data communication like web browsing	For application limited to periphery of 10 km like Cable net

(f) With block diagram explain working of Tele cardiology.

ANS: (diagram2M, explanation 2M)

Telecardiology



Teleradiology system is a system used for sending raw data from a complete patient study to a remote location for a radiologist to make a final decision.

A teleradiology system consists of an image acquisition system, an image server to compress, and a telecommunication network to transmit the images.
The input signals are analog data from electrocardiogram (ECG) acquired from conventional chest electrodes, x-ray data from x-ray data acquisition systems, or digital data from other types of physiological sensors.
The processor is a computer that can have any amount of memory. Since the signals are from many channels, multiplexing is done to send the desired signal based on a priority scheme in a particular time instant.
Signals from the telephone are transmitted.

6. Attempt any FOUR: 16

(a) Represent the data 10110100 using following formats:

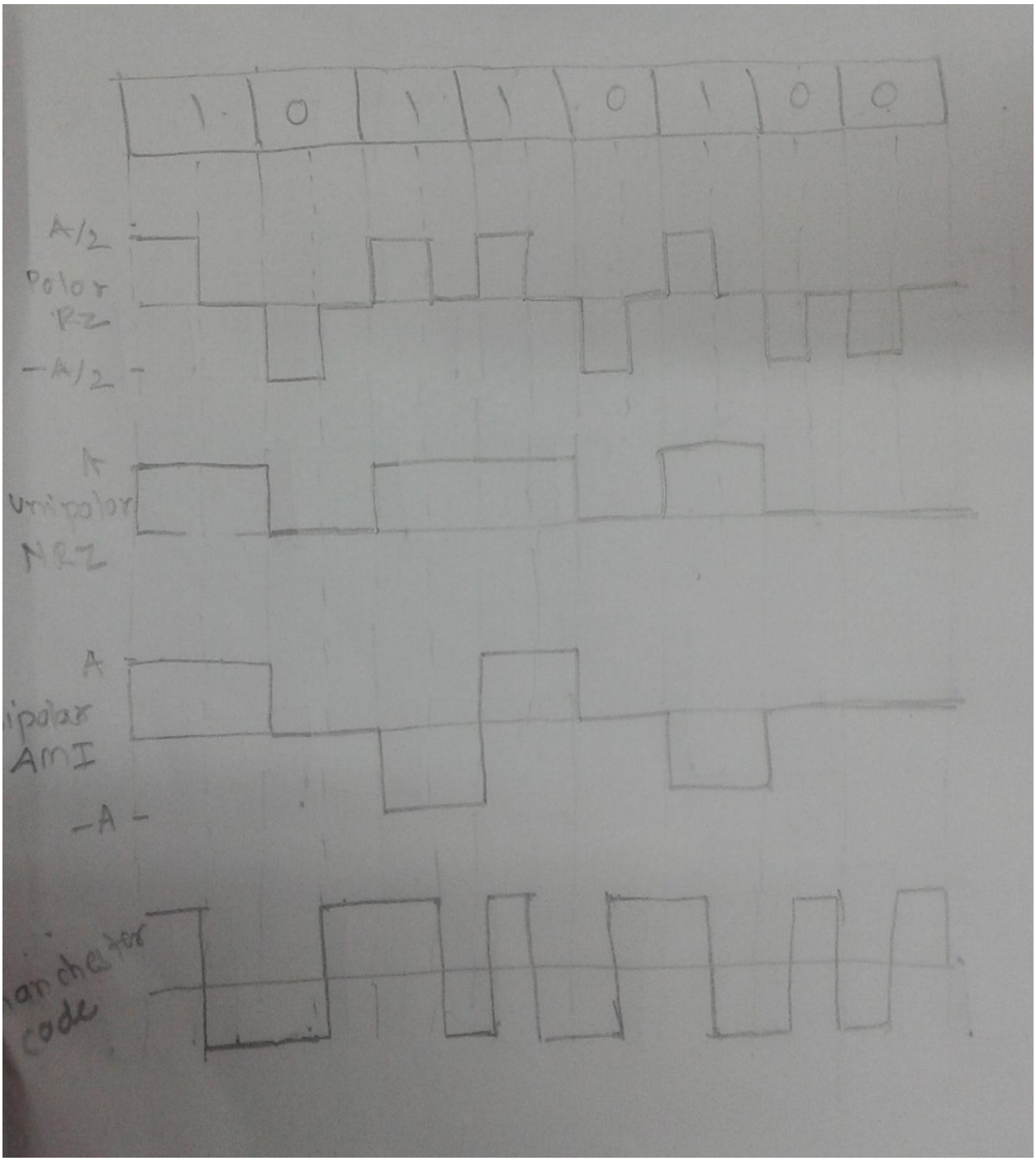
(ii) Polar RZ

(iii) Unipolar NRZ

(iv) Bipolar AMI

(v) Manchester Code

ANS: (each 1M)



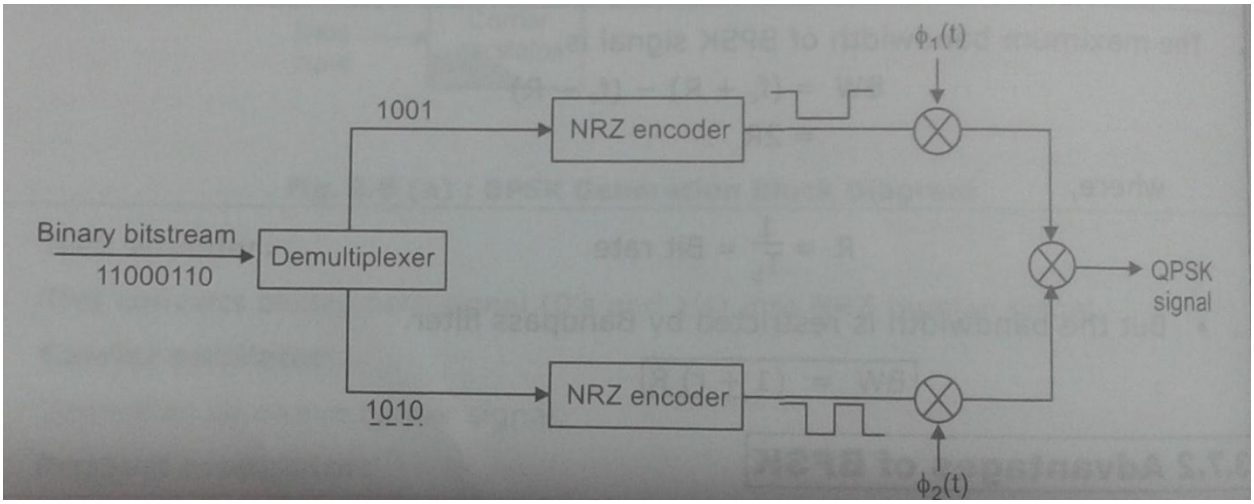
(b) What is QPSK? State its principle. Draw block diagram to generate QPSK.
ANS: QPSK- 1mks, principle- 1 mka, block diagram- 2 mks)

QPSK is a digital modulation in which the group of binary data result in four possible output phases.

Principle: The digital input to QPSK is a binary number having four binary combinations 00, 01, 10 and 11. Therefore with QPSK , the binary input data are combined into groups of two bits, called dibits. Each dibit code generate one of the four possible output phases ($+45^0$, $+135^0$, $-45^0$and -135^0). Therefore, for each two bit dibit clocked in to the modulator, a signal output change occurs and the rate of change of output is equal to one-half the input bit.

As shown in the figure the binary data stream is split into the in-phase and quadrature phase components. The binary data stream is split into the inphase and quadrature-phase components. These are then separately modulated onto two orthogonal basic functions. In this implemention two sinusoidal are used. Then, the two signals are superimposed and the resulting signal is QPSK. Polar non-return-to-zero(NRZ) incoding can be placed before for binary data source, but have been placed after to illustrate the conceptual difference between digital and analog signals involved with digital modulation.

Block diagram for generation-



(c) What is Quantization? With neat diagram show quantization error.

ANS: (Quantization- 2 mks, diagram- 2 mks)

Quantization is a process of approximation or rounding off the signal. Quantizer converts the sample signal into an approximate quantized signal which consist of only finite number of pre divided voltage levels. Each sampled value at the input of quantizer is approximated or rounded off to the nearest standard pre divided voltage level hence called as quantization levels.

Quantization error:-The difference between Xp(t) quantized and X(t) original signal is called quantization error.

m(t) is the signal to be quantized.

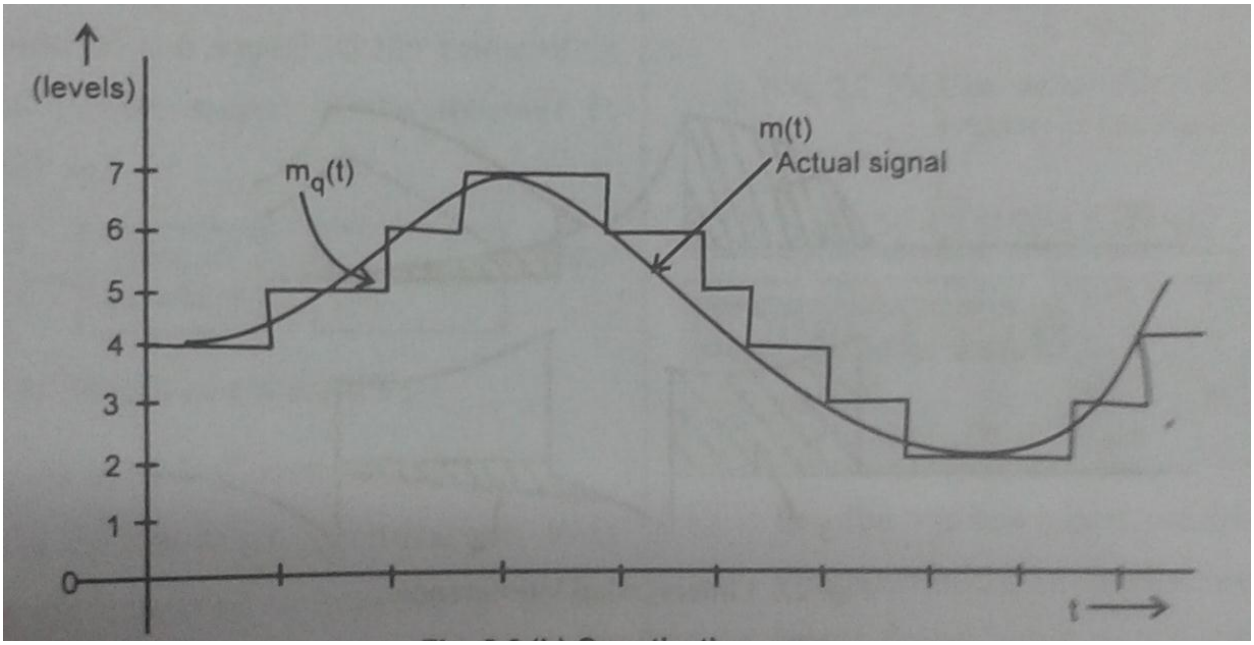
mq(t) is the quantized result.

The quantized error = m(t)-mq(t).

The difference between the m(t) and mq(t) is called quantization error.

To reduce quantization error, the step size must be reduced. Hence the number of level between the given range must be increased.

Figure:



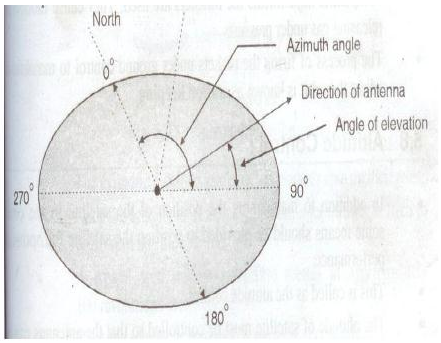
(d) What are the different types of satellite orbits? Explain (i) Elevation angle (ii) Azimuth angel.

ANS: (Different types-any two- 2M, both angle definition- 1 mks each)

There are three common orbital patterns used in satellite communication:
1. Polar orbit: A satellite orbit in which the satellite passes over the North and South poles on each orbit, and eventually passes over all points on the earth. The angle of inclination between the equator and a polar orbit is 90 degrees.
2. Inclined orbit: A satellite is said to occupy an inclined orbit around the Earth if the orbit exhibits an angle other than zero degrees with the equatorial plane.
3. Equatorial orbit: A satellite in equatorial orbit flies along the line of the Earth's **equator**. To get into equatorial orbit, a satellite must be launched from a place on Earth close to the equator.

Elevation Angle:-

It is the vertical angle formed between the direction of travel of an electromagnetic wave radiated from an earth station antenna pointing directly towards the satellite & the horizontal plane.



Azimuth Angle: -It is defined as the horizontal pointing angle of an earth station antenna. It is usually measured in a clockwise direction in degrees from true north.

(e) Compare TDMA, FDMA and CDMA. (4 points)

ANS: (Relevant four points- each 1M)

Sr. No.	Parameters	TDMA	FDMA	CDMA
1	Technique	Sharing time of satellite transponder	Sharing bandwidth of satellite transponder	Sharing both time and bandwidth
2	Synchronization	Required	Not required	Not required
3	Code word	Not required	Not required	Required
4	Power efficiency	Full	Less	Full

(f) Why uplink frequency is higher than down link frequency? Write frequency ranges used for various bonds.

ANS: (Reason - any two reasons- 2M , any two frequency bands)

1. signals have to cross the atmosphere which presents a great deal of attenuation.

2. The higher the frequency, the more is the signal loss and more power is needed for reliable transmission.

3. Use higher frequencies if signal loss is more and so need more power.because lower frequencies get reflected by atmospheric bands and cannot penetrate to get through to the satellite.

4. A satellite is a light-weight device which cannot support high-power transmitters on it. So, it transmits at a lower frequency (higher the frequency, higher is the transmitter power to accommodate losses) as compared to the stationary earth station which can afford to use very high-power transmitters.

5. Uplink frequency of satellite is more because it have to overcome earth gravitational inertia.

Various uplink and downlink bands-

1.C-band : U/L-6 GHz, D/L-4 GHz

2. Ku band: U/L-14 GHz, D/L-12 GHz

3. GSM-900: U/L-890-915 MHz, D/L- 935-960 MHz

4. GSM-1800: U/L-1710-1785 MHz, D/L- 1805-1880 MHz