



Summer 2015 Examination

Subject Code: 17438

Model Answer

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 SIX of the following: 12 marks

(a) State the need of modulation.

Ans:- Modulation process is needed for following reasons- **(any 4 points, 2 mks)**

1. To reduce the height of the antenna.
2. To avoid the mixing of the signals.
3. To increase the range of communication.
4. To make multiplexing possible.
5. To improve quality of reception

(b) List the frequency bands used in satellite communication.

Ans:- **(any four frequency bands – 2 marks)**

Frequency Range(MHz)	Band
225-390	P(military)
350-530	J
1530-2700	L
2500-2700	S
3700-6425	C(commercial)
7250-8400	X(military)
11700-14500	Ku(commercial)
17700-31000	Ka(commercial)
30000-46000	Q
46000-56000	V
56000-100000	W

(c) State the network devices used for (i) connecting two similar networks

(ii) connecting two dissimilar networks

Ans:- (i) Connecting two similar networks- **'Bridge'**

(ii) Connecting two dissimilar networks- **'Router'** **(1 mks each)**

(d) State the types of distortions observed in a Delta Modulation System.

Ans :- **(any two relevant types – 2 marks)**

i) Slope overload and granular are present.

ii) Practically signaling rate with no slope overload error will be much higher than PCM.

(e) State two basic types of multiplexing.

Ans : **(1 mks each type)**

i) Frequency Division Multiplexing (FDM)- It is the most popular and is used extensively in radio and TV transmission. Here the frequency spectrum is divided into several logical channels, giving each exclusive possession of a particular frequency band, i.e, specified sub bands of frequency are allocated.

ii) Time Division Multiplexing (TDM)- It means dividing the available transmission time into time slots and allocating a different slot to each transmitter.

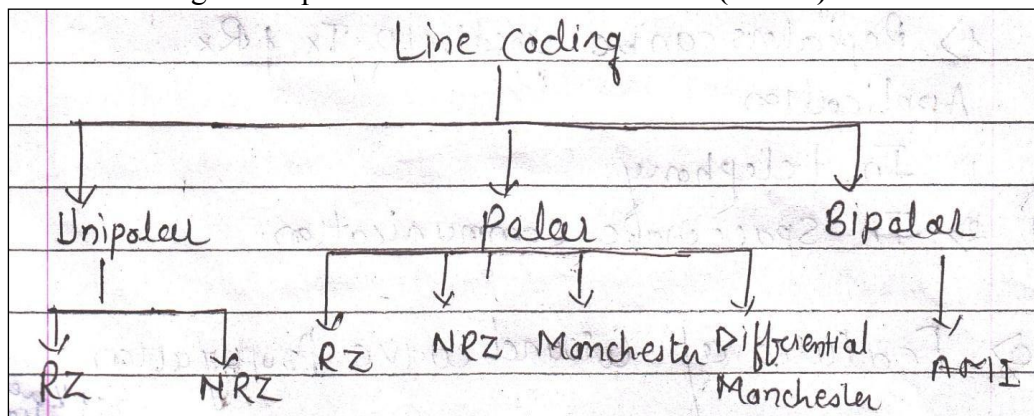
(f) Define cell splitting

Ans:- **(Proper definition 2 mks)**

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-channelled interference ratio reducing the interference. The channel capacity of the cells increases accordingly. The antenna height is reduced.

g) Give the classification of different types of encoding techniques.

Ans:- Encoding techniques are classified as- **(2 mks)**



(h) State types of multiple access techniques.

Ans:-

i) FDMA- In FDMA each user is allocated a unique frequency band or channel. During the period of call no other user can share the same frequency band. **(½ mks)**

ii) TDMA- TDMA system divides the channel time into frames. Each frame is further partitioned into time slots. In each slot only one user is allowed to either transmit or receive. Unlike FDMA only digital data and digital modulation must be used. **(½ mks)**

iii) CDMA- The communication resource being partitioned by the use of a hybrid combination of FDMA and TDMA knows as code division multiple access. CDMA is an application of spread spectrum techniques. Spread spectrum (SS) techniques can be classified as:

a. Direct sequence SS

b. Frequency hopping SS **(1 mks)**



(B) Attempt any TWO of the following:

08 marks

(a) Define PCM. Write its applications.

Ans:- **Definition:-** (2 mks)

PCM is the only digitally encoded modulation technique that is commonly used for digital transmission. PCM is not really a type of modulation but rather a form of digitally coding analog signals. With PCM the pulse are of fixed length and fixed amplitude. PCM is a binary system where a pulse or lack of a pulse within a prescribed time slot represents either logic 1 or logic 0 conditions.

Application of PCM (any two) (2 mks)

- 1) Long Range communication is possible using repeaters
- 2) Satellite transmission
- 3) Space wave communication
- 4) Multiplexed channel transmission

(b) Define handoff. List different types of handoff.

Ans:-

Hand Offs - When a mobile user travels from one area of coverage or cell to another cell within a call's duration the call should be transferred to the new cell's base station. Otherwise, the call will be dropped because the link with the current base station becomes too weak as the mobile recedes. Indeed, this ability for transference is a design matter in mobile cellular system design and is call *handoff*. (2 mks)

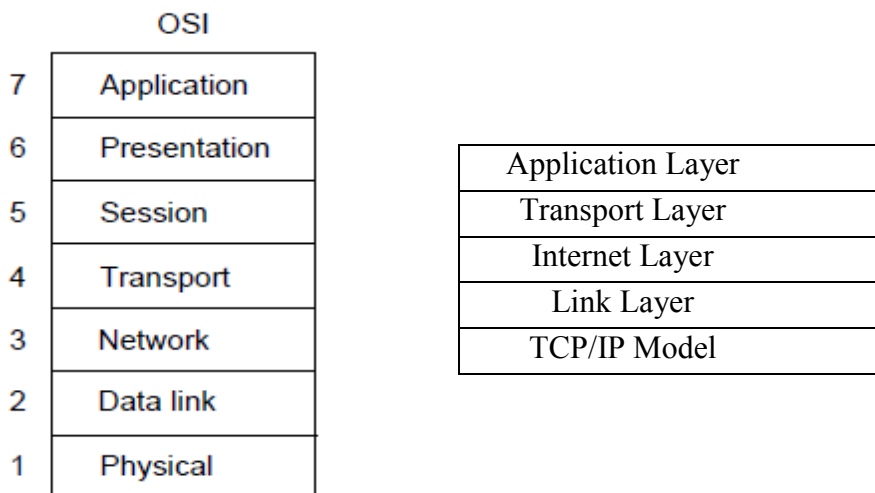
Types of hand-off:- (any 4- 2 mks)

- 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.



(c) Draw the architecture of OSI and *TCP/IP* model. Why TCP/IP is performed in network systems?

Ans:- (Architecture of OSI & TCP – 2 marks, TCP/IP explanation – 2 marks)



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.

Q.2 Attempt any four

16 marks

(a) Define frequency modulation. State ideal and practical bandwidth requirement of FM.

Ans:-

Frequency modulation- It is a process in which the frequency of carrier signal varies in accordance to instantaneous value of modulating signal. **(1 mks)**

Ideally the BW for FM is infinite. **(1 mks)**

Practically it is calculated on how much side bands have significant amplitude

- i) The simple method to calculate BW is
$$BW=2f_m \times \text{Number of significant sidebands}$$
- ii) The second method to calculate BW is by Carson's rule
$$BW=2(\delta + f_m \text{ max})$$
 (2 mks)

(b) State advantages of pulse modulation over amplitude modulation.

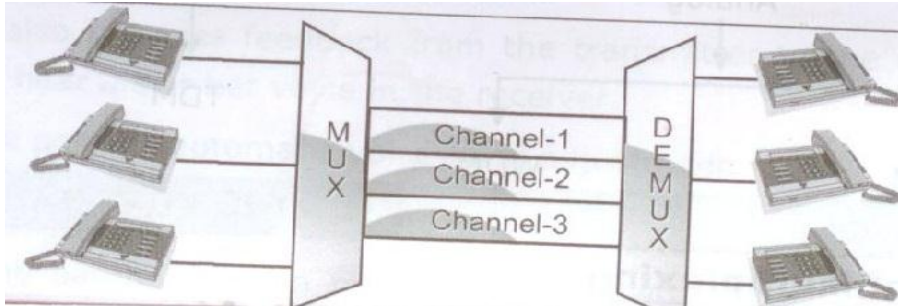
Ans:- **(4 points- 4 mks)**

- 1. Comparing to continuous wave modulation, the performance of all pulse modulation schemes except PAM in presence of noise is very good.
- 2. Due to better noise performance, it requires less power to cover large area of communication.

3. Due to better noise performance and requirement of less signal power, pulse modulation is most proffered for the communication between space ships and earth.
4. Efficiency is better.

(c) With neat diagram, describe the principle of FDM.

Ans:- **(Diagram 2mks, explanation 2 mks)**



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.

(d) Draw ASK signal and FSK signal for the following data, 101010001101.

Ans:- **(proper waveforms 2 mks each)**



(e) Find percentage modulation when $E_{max} = 132 \text{ Vpp}$ and $E_{min} = 28 \text{ Vpp}$. Draw AM waveform.

Ans:- (Correct modulation index value – 2 marks, AM waveform – 2 marks)

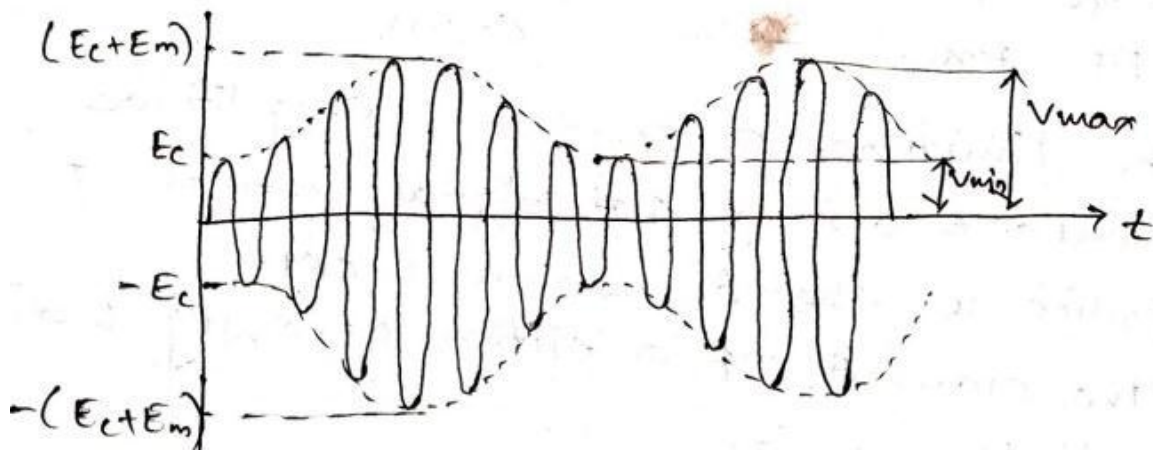
% Modulation for AM is given as

$$m_a = \frac{E_{max} - E_{min}}{E_{max} + E_{min}} \times 100$$

$$= \frac{132 - 28}{132 + 28} \times 100$$

$$= 0.65 \times 100$$

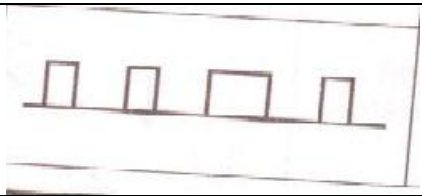
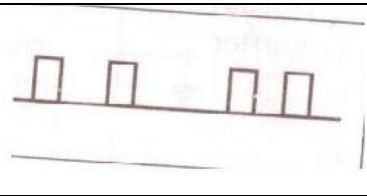
$$= 65\%$$



(f) Compare PPM and PWM with respect to

- (i) Bandwidth
- (ii) Transmitted power
- (iii) Variable parameter of carrier
- (iv) Output waveform

Ans:- (four correct points – 4 marks)

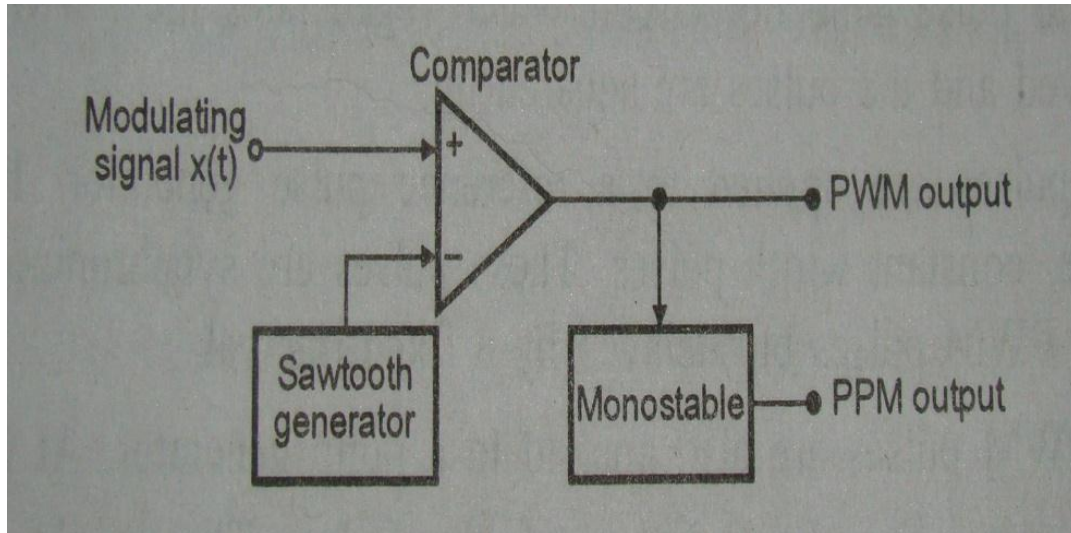
PARAMETER	PWM	PPM
(i) Transmitted power	Varies with variation in width	Remains constant
(ii) Bandwidth requirement	High	High
(iii) Output waveform		
(iv) Variable parameter of carrier	Width of carrier pulse	position of carrier pulse

3. Attempt any FOUR of the following:

16 marks

(a) With neat circuit diagram, explain generation of PWM.

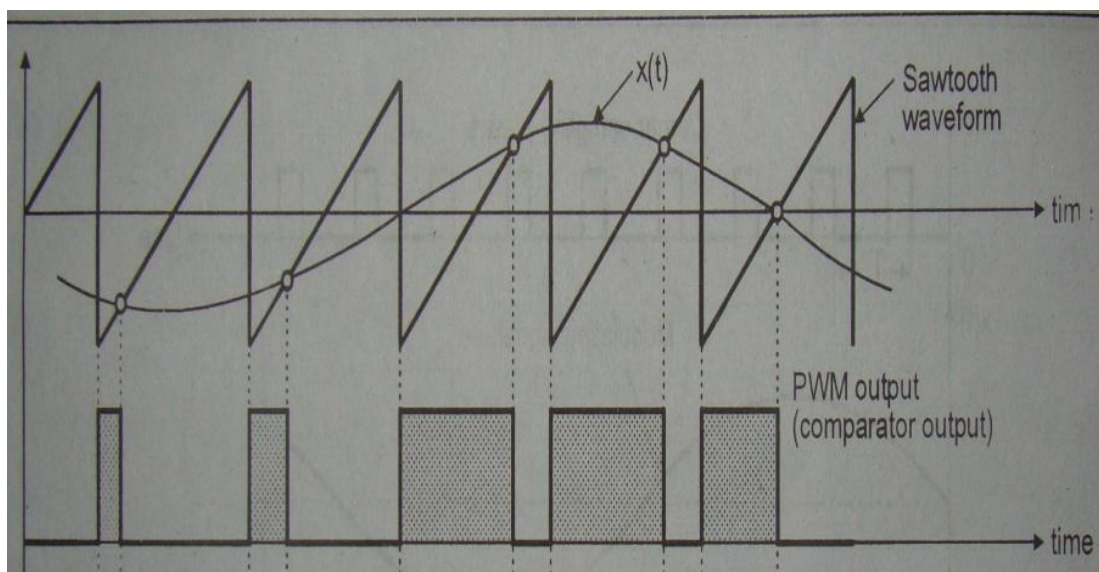
Ans:- (Circuit diagram- 2 mks, explanation-1mks, waveforms-1 mks)



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 f_s , 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.





(b) Compare AM and FM on the basis of sidebands, bandwidth, noise immunity and transmission frequencies used.

Ans:- (Relevant points- 4 mks)

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

(c) Write step by step procedure for cellular call processing from cellular (mobile) to wire line (PSTN).

Ans:- (Proper steps- 4 marks)

1. Calls from mobile telephones to wire line telephones can be initialized in one of two ways:

a.) The mobile unit is equivalently taken off hook (usually by depressing a talk button).

After the mobile unit receives a dial tone, the subscriber enters the wire line telephone number using either a standard Touch-Tone keypad or with speed dialing after the last digit is depressed, the number is transmitted through a reverse control channel to the base station controller along with the mobile unit's unique identification number (which is not the mobile unit's telephone number).

b) The mobile subscriber enters the wire line telephone number into the unit's memory using a standard Touch-Tone keypad. The subscriber then depresses a send key, which transmits the called number as well as the mobile unit's identification number over a reverse control channel to the base station switch.

2. If the mobile unit's ID number is valid, the cell-site controller routes the called number over a wire line trunk circuits to the MTSO.

3. The MTSO uses either standard call progress signals or the SS7 signaling network to locate a switching path through the PSTN to the destination party.

4. Using the cell-site controller, the MTSO assigns the mobile unit a non-busy user channel and instructs the mobile unit to tune to that channel.

5. After the cell-site controller receives verification that the mobile unit has tuned to the selected channel and it has been determined that the called number is on hook, the mobile unit receives an audible call progress tone (ring -back) while the wire line caller receives a standard ringing signal.

6. if a suitable switching path is available to the wire line telephone number, the call is completed when the wire line party goes off hook (answer the telephone)

d) What is bandwidth requirement for FM in which the modulation index is 5 and maximum deviation is 15 KHz? (Assume highest needed sideband =6)

Ans:- Given - $m_f = 5$

$$\delta_f = 15 \text{ KHz}$$

$$\text{No of sidebands} = 6$$

$$m_f = \delta_f / f_m,$$

$$\text{So } f_m = \delta_f / m_f$$

$$= 5 \text{ KHz}$$

Bandwidth is given as

$$BW = 2(\delta_f + f_m)$$

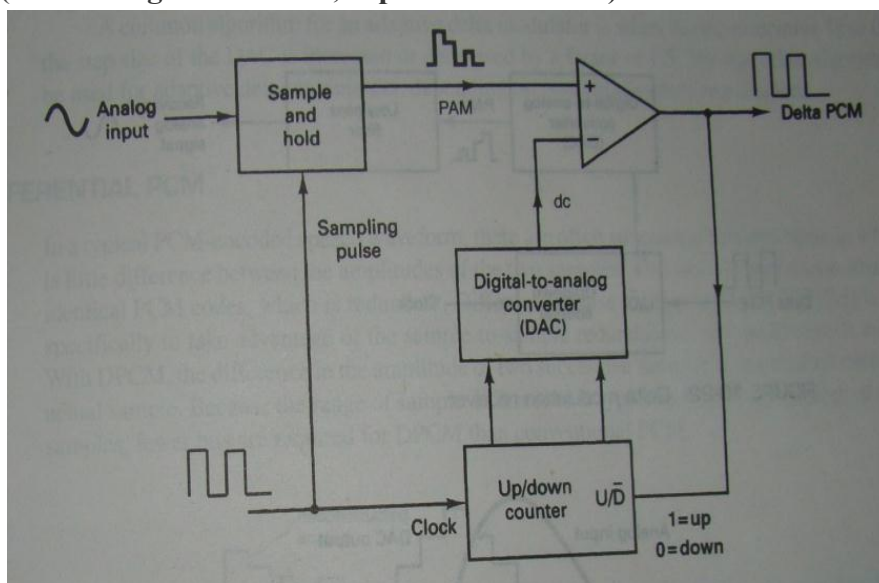
$$= 2(15 + 5) \text{ KHz}$$

$$= 40 \text{ KHz}$$

(4 marks)

(e) Draw neat block diagram of delta modulator and describe its working.

Ans:- (**Block diagram – 2 mks, explanation- 2 mks**)





Explanation- In figure above, the input analog is sampled and converted to PAM signal, which is compared with the output of DAC. The output of DAC is a voltage equal to regenerated magnitude of the previous sample, which was stored in the up-down counter as a binary number. The up-down counter is incremented or decremented depending on whether the previous sample is larger or smaller than the current sample. The up-down counter is clocked at a rate equal to the sample rate. Therefore up-down counter is updated after each comparison. Initially, the up-down counter is zeroed, and the DAC is outputting 0V. The first sample is taken, converted to a PAM signal, and compared with zero volts.

The output of comparator is a logic 1 condition (+V), indicating that the current sample is larger in amplitude than the previous sample. On the next clock pulse, the up-down counter is incremented to count of 1. The DAC now outputs a voltage equal to the magnitude of the minimum step size (resolution). With the input signal shown, the up-down counter follows the input analog signal up until the output of the DAC exceed the analog sample; then the up-down counter will begin counting down until the output of DAC drops below the sample amplitude

(f) State the basic concept of following:

(i) Teledermatology

(ii) Telesurgery

Ans:-Teledermatology-

2mks

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.

Telesurgery-

2 mks

Telesurgery-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 surgery used to perform micro procedure such as vascular repair& laser retinal surgery.

4. Attempt any FOUR of the following:

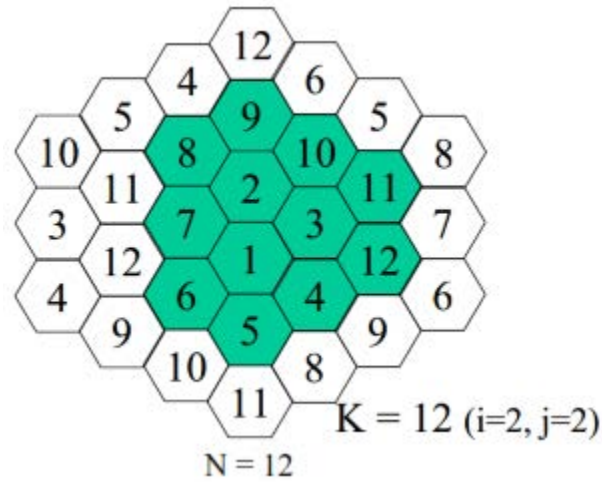
16 marks

(a) Describe the concept of frequency reuse.

Ans:-**(Concept 2 mks, diagram 2 mks)**

Frequency reuse- Frequency reuse is the process in which the same set of frequencies (channels) can be allocated to more than one cell. Provided the cells are separated by sufficient distance reducing each cells coverage area invites frequency reuse cells using the same set of radio channels can avoid mutual interference, provided they are properly separated. Each cell base station is allocated a group of channel frequencies that are different from those of neighboring cells & base station antennas are chosen to achieve a desired coverage pattern within its cell. However as long as a coverage area is limited to within a cells boundaries the same group of channel frequencies may be used in different cells without interfacing with each other provided the two cells are sufficient distance from one another.

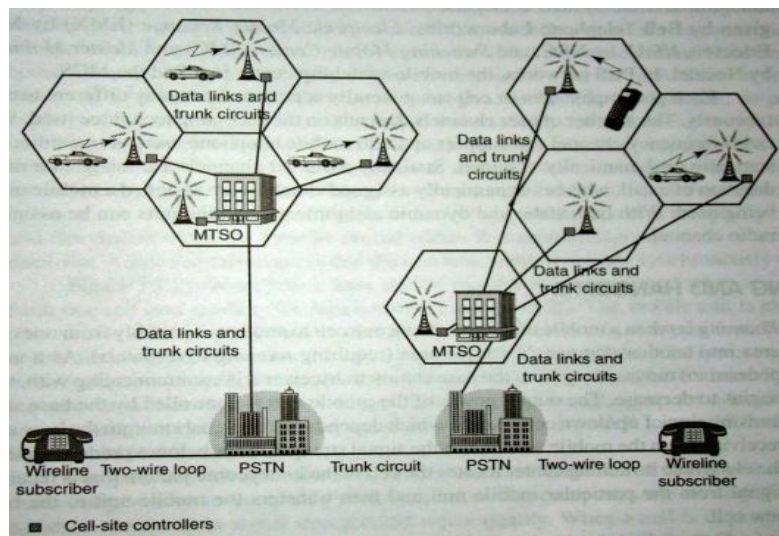
Pattern for frequency reuse



b) Draw neat block diagram of Mobile Communication System and describe each block.

Ans:- (Block diagram -2 mks, description- 2mks)

Note:-Student can interpret block diagram in different way but it should consist basic blocks marks should be given for that also.



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) State the meaning of the terms:

1. Hub
2. Repeater
3. router
4. gateway

Ans :- (Each definition-1 mks)

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 servers to internet or two or more networks such as LAN.MAN or WAN or its ISPs. It is combination of hardware and software.

iv) **Gateway:-** It is used to interconnect two different type networks like AppleTalk & Ethernet to connects two different dissimilar networks which has similar function of communication. It is also called as protocol convertor. It works in all layers of OSI model. Gateway operates at all 7 layers of the OSI model.

(d) List network connecting devices, explain anyone connecting device.

Ans:-(List any 4 -2 mks, any one explanation-2 mks).

Various network connecting devices are-

- 1) switch
- 2) router
- 3) gateways
- 4) hub
- 5) repeaters etc

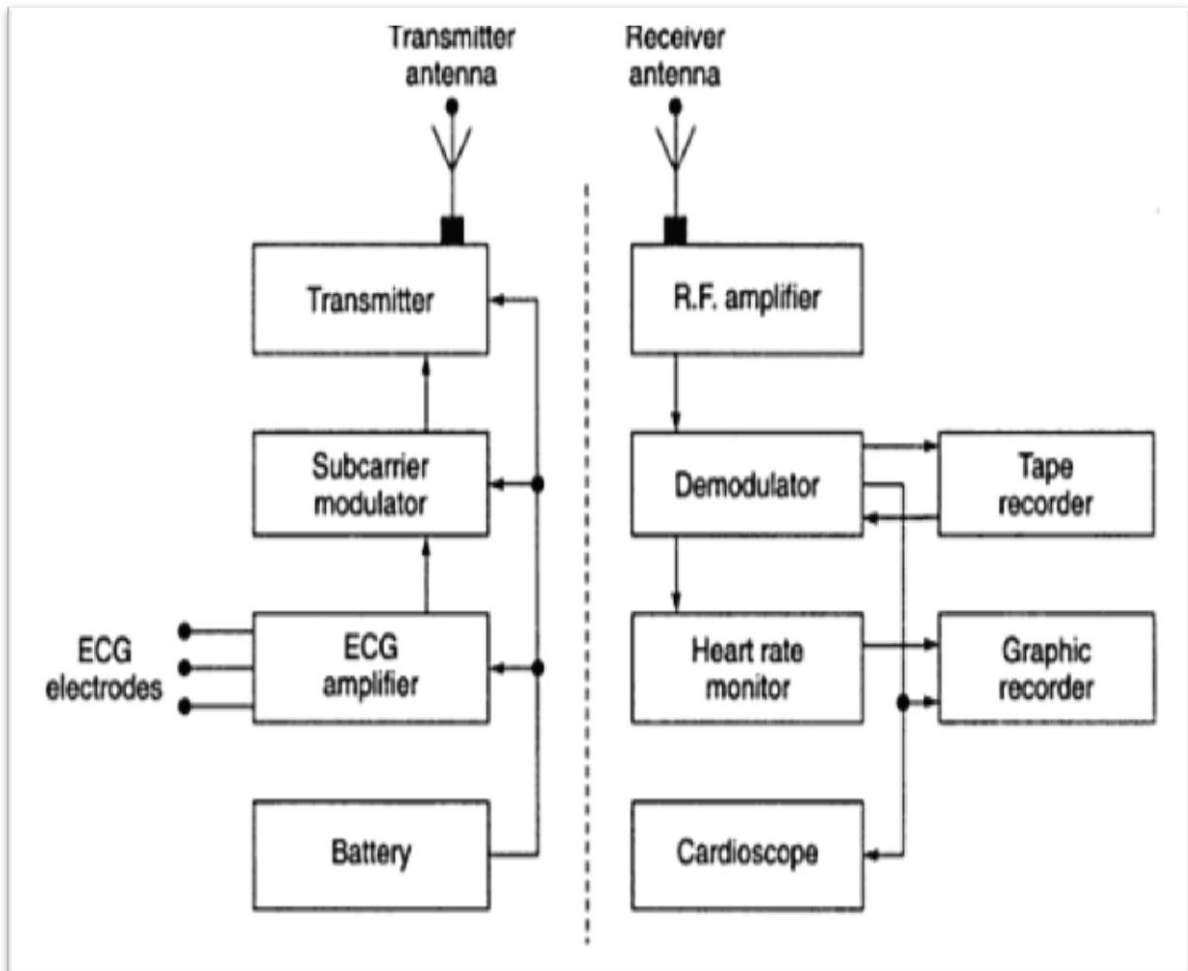
Router:

Router is a device that connects two or more networks. It consists of a combination of hardware and software.

- 1) A router is a specialized computer connected to more than one n/w
- 2) Router operate at the n/w layer
- 3) The primary function of a router is to connect n/w together & keep layer 2 broadcast traffic under control.
- 4) A router is typical connected to at least two n/w commonly two LAN OR WAN or LAN and its ISP s n/w or more n/w connects.
- 5) Routers are located at gateways, the places where two or more n/w connect.
- 6) Types of Router are Static and Dynamic Routers.

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

Ans;-(Block diagram- 2 mks, description- 2 mks)



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.

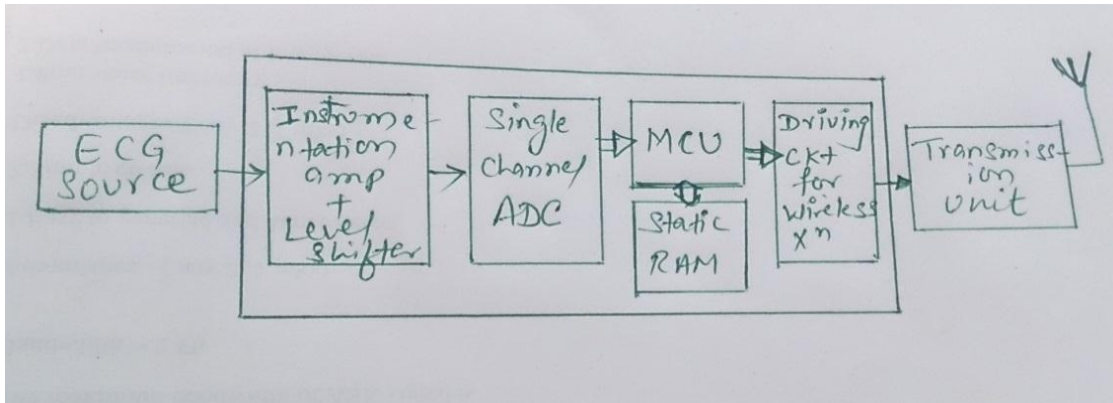
Receiver:– it uses unidirectional quarter wave monopole receiving antenna which receives signals .These signals are in turn fed to RF amplifier RF amplifier which performs RF filtering &image frequency rejection & it prevents cross coupling .The output of RF amplifier is fed to demodulator .demodulator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

f) Draw block diagram of following:

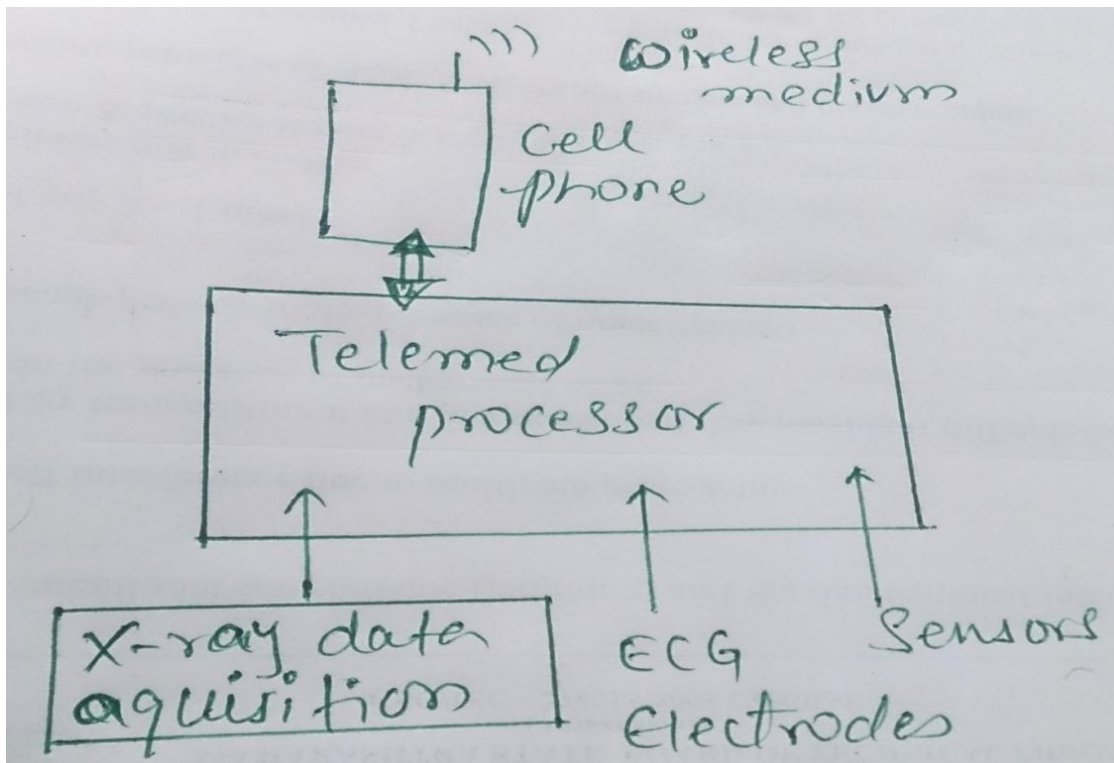
1. Teleradiology
2. Telecardiology

Ans:- (Proper diagram - 2mks each)

Teleradiology



Telecardiology



5. Attempt any FOUR of the following:

16 marks

(a) State different modes of data transmission. Differentiate between synchronous and asynchronous transmission.

Ans:- (statement of modes -2 mks ,comparison 2 mks (any four valid points))

Different types of data transmission modes are as follows:

- a) Serial transmission (synchronous, asynchronous, isochronous)
- b) Parallel transmission

OR

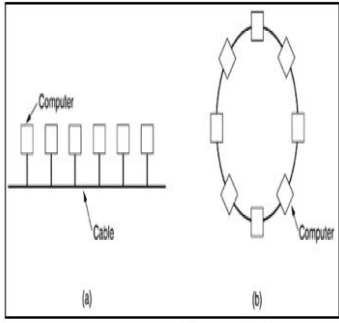
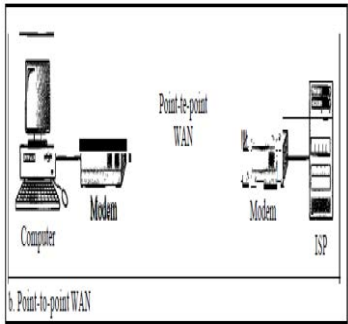
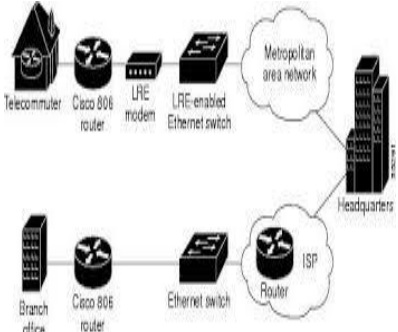
- 1. Simplex mode
- 2. Half-duplex mode
- 3. Full-duplex mode

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

(b) Compare LAN, WAN and MAN with respect to following points:

- (i) Extend of geographical area
- (ii) Basic structure diagram
- (iii) Speed
- (iv) Application

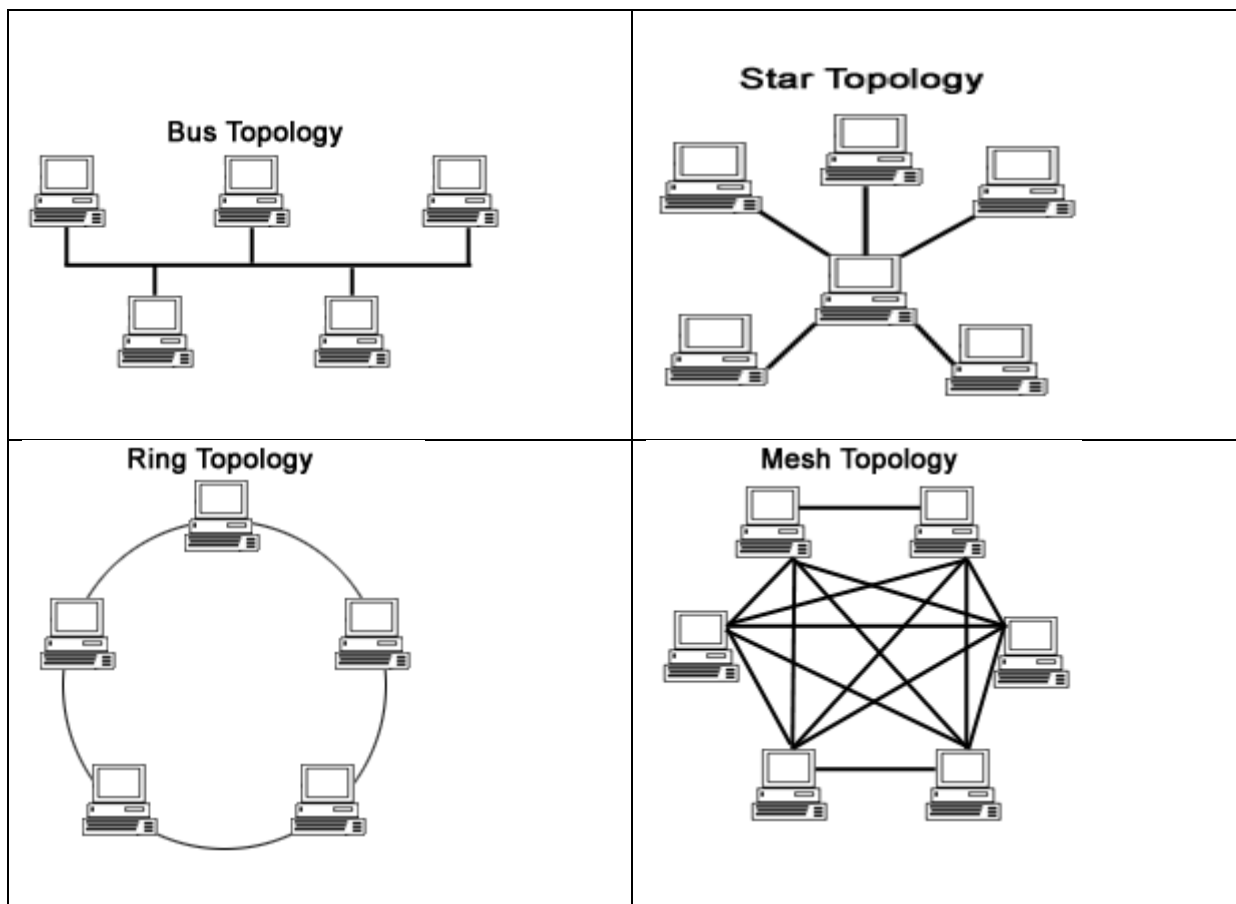
Ans:- (1mks Each point)

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

(c) Draw neat diagrams of following topologies: Bus, star, ring, mesh

Ans:- (1 mks per diagram)





(d) What is uplink and downlink in satellite communication? Why uplink frequency is greater than the downlink frequency?

Ans:- (uplink and downlink 1 ½ mks each, explanation of high uplink frequency- 1 mks)

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.

Uplink Frequency of satellite is more because it have to overcome earth gravitational Inertia.

(e) Which mode of transmission is preferred for long distance data transmission and why?

Ans:- (name 1 mks, reason – 3 mks)

Serial data transmission is selected for long distance data transmission as it requires only one communication channel rather than n no of channels between two devices hence it reduces cost by factor of n over parallel transmission .

Cost of connecting devices of parallel transmission is also high.

Parallel transmission requires extraordinary accuracy which cannot be guaranteed over long distance.

Data through all channels cannot travel at same speed hence problem of skew is possible in parallel transmission

(f) State advantages and disadvantages of telemedicine.

Ans:- (2mks advantages 2 mks, disadvantages 2 points each)

Advantages:-

- i) Doctor can attend patient at remote location without being in front of patient physically
- ii) Expenses Decreases.
- iii) Doctor can attend patient immediately form remote location without traveling

Disadvantages:-

- i) Doctor cannot take readings by using specific instruments
- ii) Lack of some clinical information
- iii) It completely dependent on connectivity

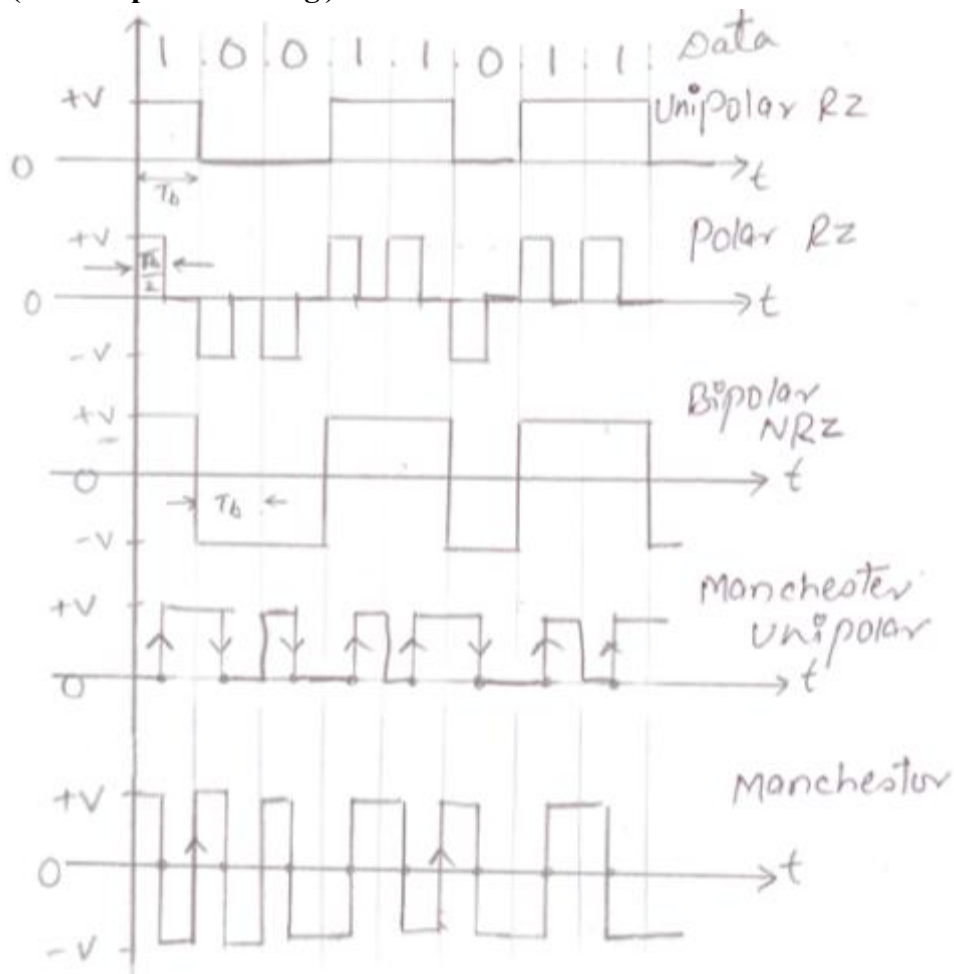
6. Attempt any FOUR of the following:

16 marks

(a) Draw the waveform for bit stream 10011011 for

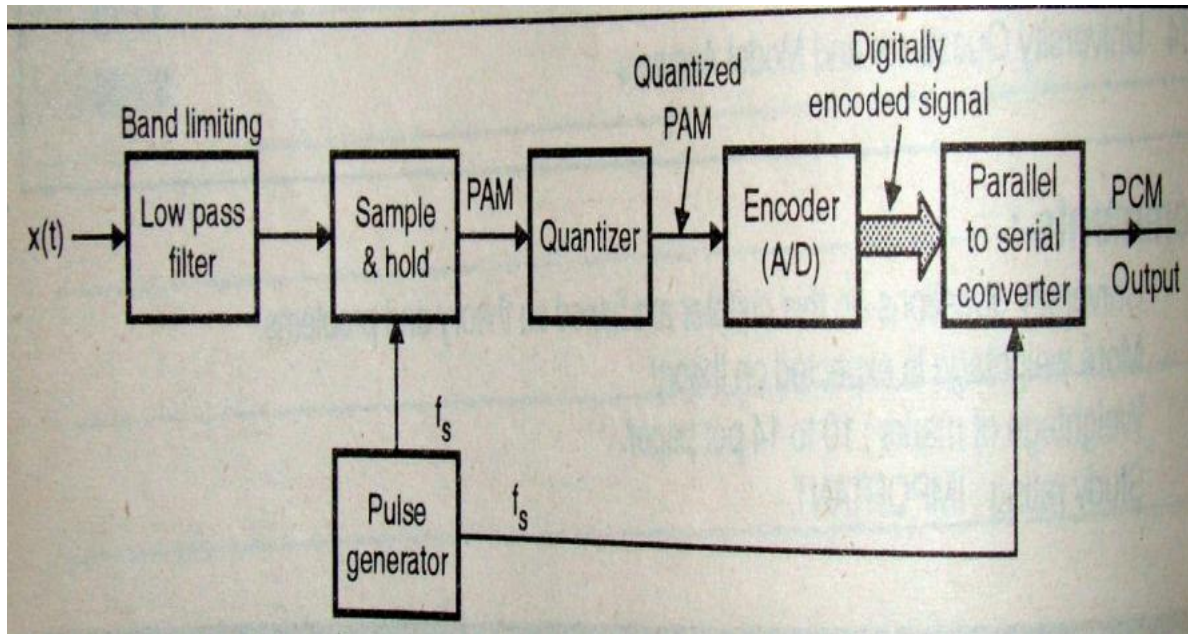
1. Unipolar NRZ
2. Polar RZ
3. Bipolar AMI
4. Manchester code

Ans: (1 mks per coding)



b) Draw the block diagram of PCM transmitter. State the role of sample and hold circuit.

Ans:- (diagram – 3 marks, role of sample & hold – 1 mark)



Role of sample and hold circuit.- It converts analog signal into sampled signals so as to convert it into digital form.

c) State the bandwidth requirement for FSK, BPSK, QPSK and DPSK.

Ans:- (each correct bandwidth – 1 mark)

Bandwidth for -

1) BFSK: $4 F_b$,

2) BPSK: $2 F_b$

3) QPSK: F_b ,

4) DPSK = F_b , Where F_b is Bit Frequency of data signal

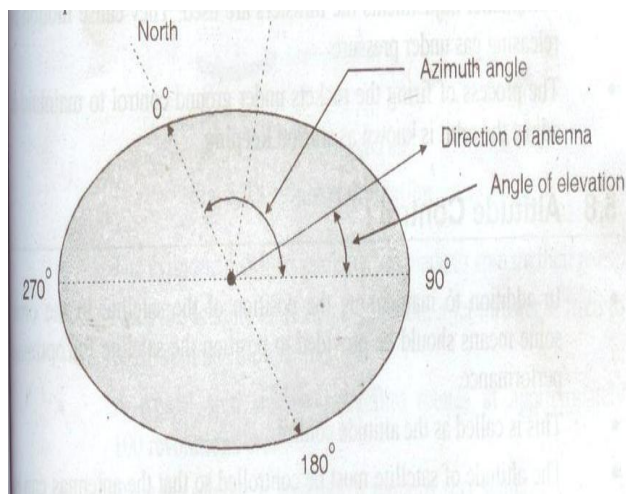
(d) Define elevation and azimuth angle of satellite with neat diagram.

Ans: (1mks per definition 2 mks diagram)

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.

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.



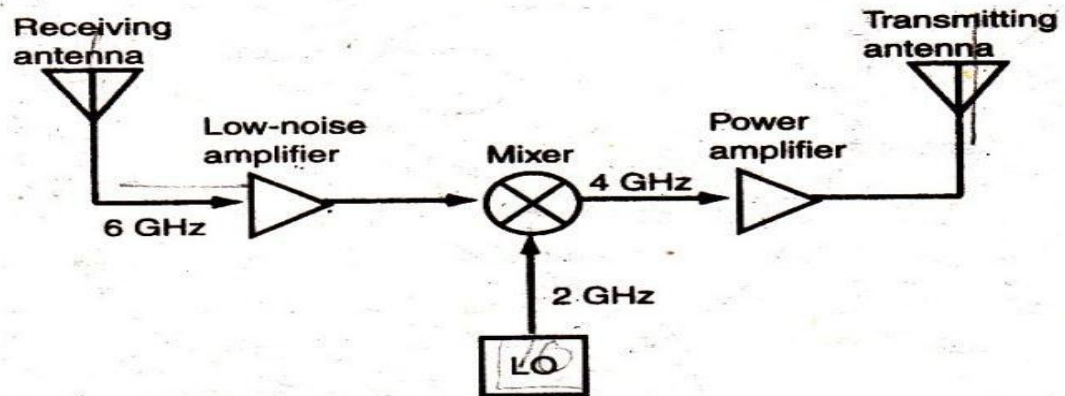
(e) Compare TDMA and FDMA for four points.

Ans: (1 mks each Point)

Sr. no	TDMA	FDMA
1	Time sharing of satellite transponder takes place.	Overall bandwidth is shared among many stations.
2	Synchronization is essential.	Synchronization is not essential.
3	It is suitable for digital voice signals.	It is suitable only for analog signal.
4	It is possible to store digital information.	Storage, enhancement of signal is not possible.
5	TDMA Diagram	FDMA diagram

(f) Draw basic block diagram of a transponder and explain the function of each block.

Ans:- (Diagram 2 mks 2 mks description)



Operation:-

Satellite antenna:-This antenna is used to pick up the receiving signal as well as to transmit the signal. The uplink signal is picked up by the receiving antenna and is first routed to a low noise amplifier.

Low Noise amplifier:-The signal is very weak even though it has been multiplied somewhat by the gain of the receiving antenna. LNA is used to increase the level of the signal, and the signal is amplified.

Mixer:-The amplified signal is then given to the mixer and it is used to translate in the downlink frequency.

Power amplifier:-The downlink signal is amplified by high power amplifier.

Diplexer:-The function of diplexer is to isolate the uplink signal from the downlink. It avoids the interference between the uplink and downlink signal.