MODEL ANSWER

SUMMER – 2018 EXAMINATION

Subject: Communication Technology **Subject Code:** **17519**

Important Instructions to examiners:

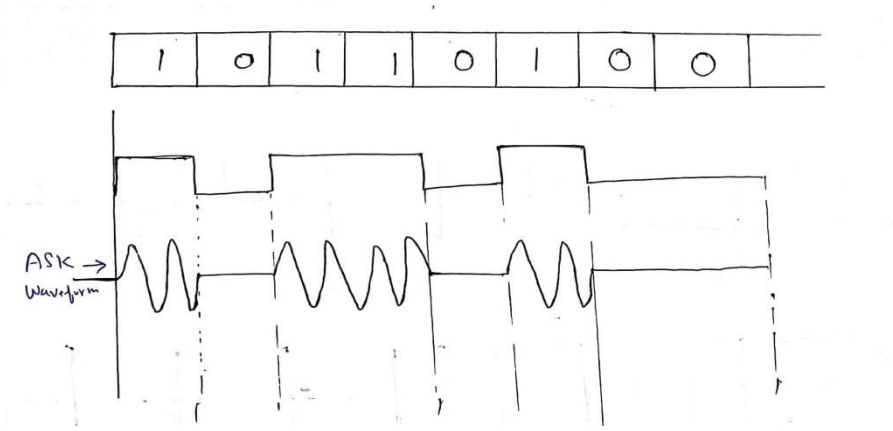
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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. No.	Sub Q.N.	Answer	Marking Scheme
1	**a) i) Ans.**	**Attempt any three:** **Define modulation index for AM and FM. State its importance.** **Modulation index for AM:** The ratio of peak amplitude of modulating signal (V_m)to the peak amplitude of carrier signal (V_c). It is denoted by m. $$m = \frac{V_m}{V_c}$$ **Modulation index for FM:** The ratio of frequency deviation to the frequency of modulating signal. It is denoted by m_f. $$m_f = \frac{\delta}{f_m}$$ **Importance of modulation index in AM:** It is used to determine the strength and quality of transmitted signal. If the modulation index is small then the amount of variation in the carrier amplitude is small. Thus the audio signal transmitted will not be strong. The greater degree of modulation, stronger and clearer will be the audio signal during reception.	**12** **4M** ***Define AM and FM 1M each*** ***Importance 2M***

MODEL ANSWER

SUMMER – 2018 EXAMINATION

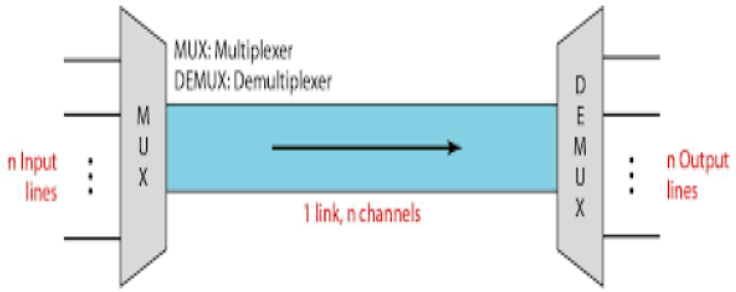
Subject: Communication Technology **Subject Code: 17519**

		Importance of modulation index in FM: The modulation index influences the amplitudes of the different sideband frequency components in FM. For certain values of modulation index the carrier can disappear completely and the entire FM wave consist of sideband components for such values. The increase in the modulation index for FM implies increased depth of modulation which require more bandwidth for transmission.	
	ii) **Ans.**	**Draw the waveform for ASK for bit sequence 10110100. Give two advantages of ASK over FSK.** **Waveform for ASK:**  **Advantages ASK over FSK:** 1 .Bandwidth less than FSK signal. 2. Therefore FSK is extensively used in low speed modems having bit rates below 1200 bits/sec. 3. The FSK is not preferred for the high speed modems because with increase in speed, the bit rate increases. 4. This increases the channel bandwidth required to transmit the FSK signal. 5. As the telephone lines have a very low bandwidth, it is not possible to satisfy the bandwidth requirement of FSK at higher speed. Therefore FSK is preferred only for the low speed modems.	**4M** ***Waveform 2M*** ***Any two advantage 2M***
	iii) **Ans.**	**Define multiplexing. State its types. What is the need for multiplexing?** **Multiplexing:** It is process of simultaneously transmitting two or more individual signals over single communication channel.	**4M** ***Definition 1M***

MODEL ANSWER

SUMMER – 2018 EXAMINATION

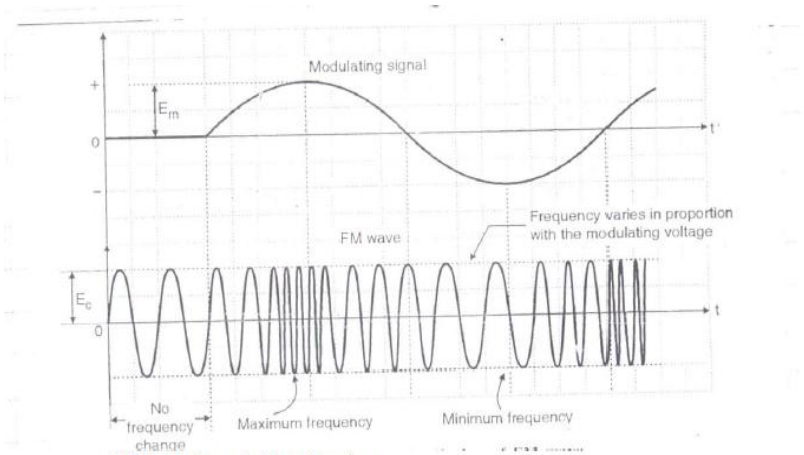
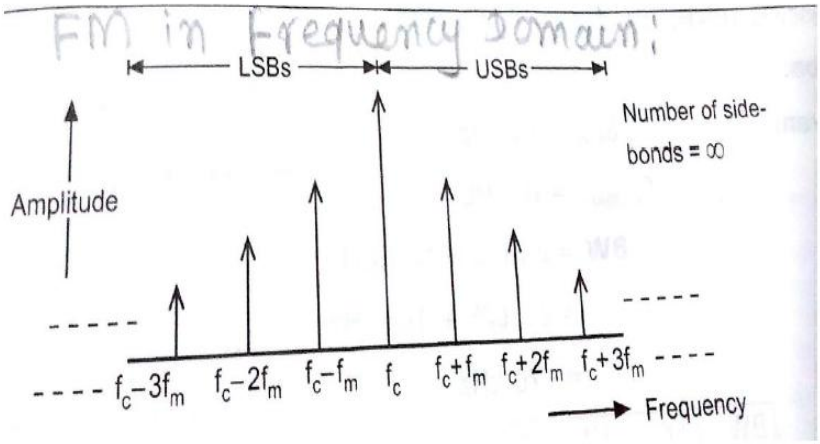
Subject: Communication Technology **Subject Code: 17519**

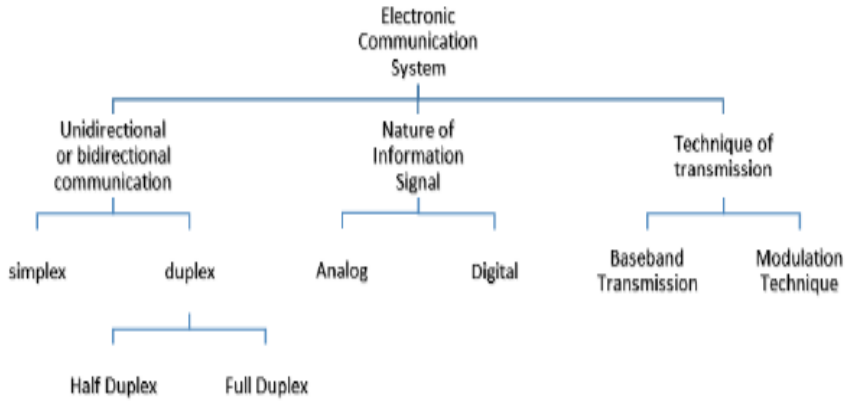
		 **Types of multiplexing:** 1. Frequency Division Multiplexing (FDM) 2. Time Division Multiplexing (TDM) 3. Wavelength Division Multiplexing (WDM) **Need of multiplexing:** 1. In the applications like telephony, there are large number of users involved. 2. It is not possible to lay a separate pair of wires from each subscriber to all the other subscriber. This is very expensive and practically impossible. 3. Instead if we use the multiplexing, then we can use a common communication medium such as a coaxial cable or an optical fiber to carry telephone signals originated from a number of subscribers. 4. The same principle is applicable to every application in which many signals from different sources are to be sent over a single communication medium.	***Types 1M*** ***Any two need 2M***
	iv) Ans.	**Draw FM wave in time and frequency domain.**	**4M**

MODEL ANSWER

SUMMER – 2018 EXAMINATION

Subject: Communication Technology **Subject Code: 17519**

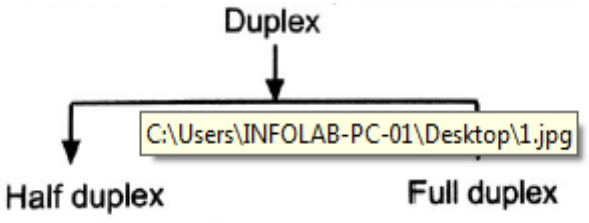
		 **FM waveform in time domain** 	***2M time domain waveform & 2M Frequency domain waveform***
1.	**b) i)** **Ans.**	**Attempt any four:** **Give the classification of communication system. Define Amplitude modulation and frequency modulation.**	**6** **6M**



Classification 4M & Definition 2M

Simplex:
In simplex communications, the information travels in one direction only, so called unidirectional system.

Duplex: The bulk of electronic communications however is two way communications.



Half duplex:
i) Half duplex is bidirectional or two way communication system.
ii) Half duplex can transmits as well as receives information but not simultaneously.

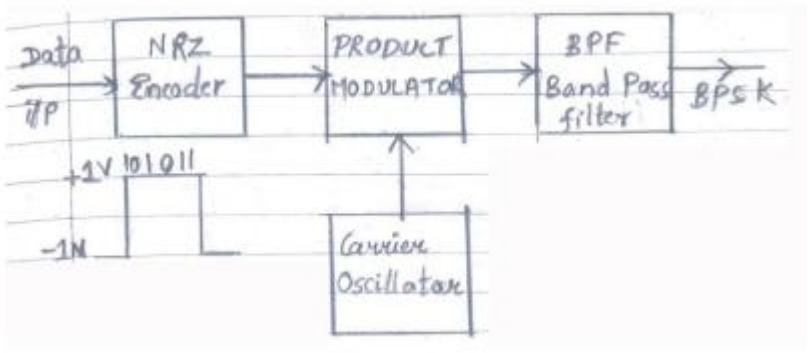
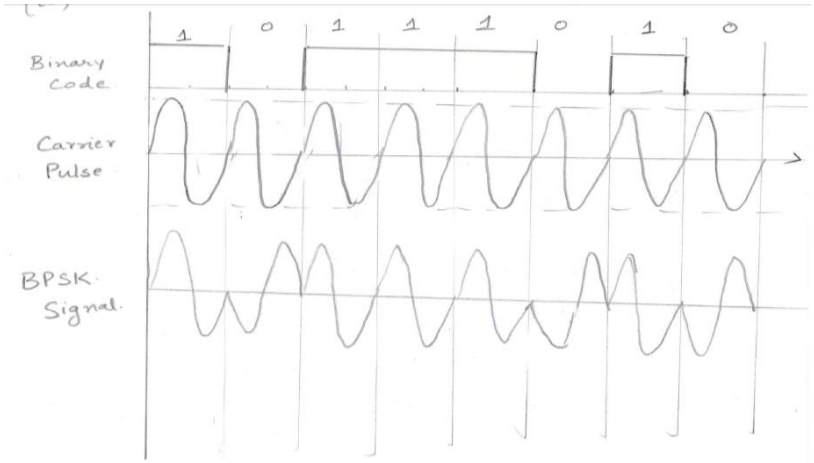
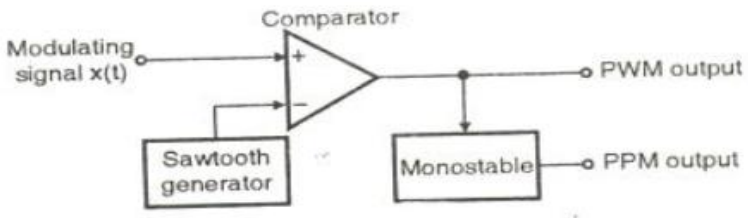
Full Duplex:
i) Full duplex is truly bi- directional o two way communication system.

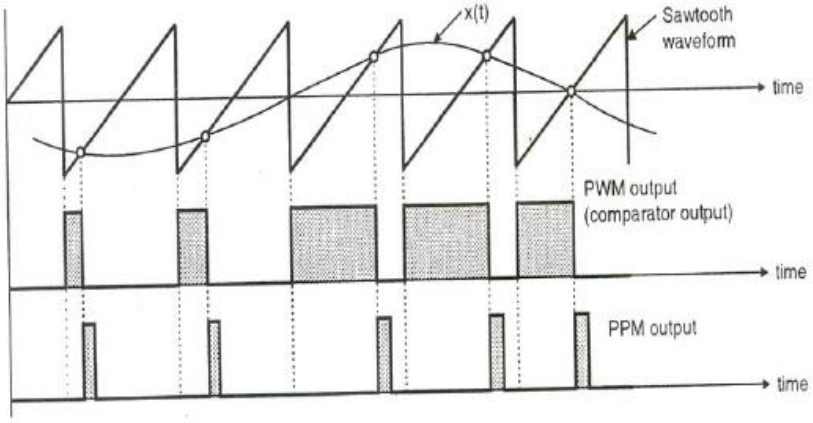
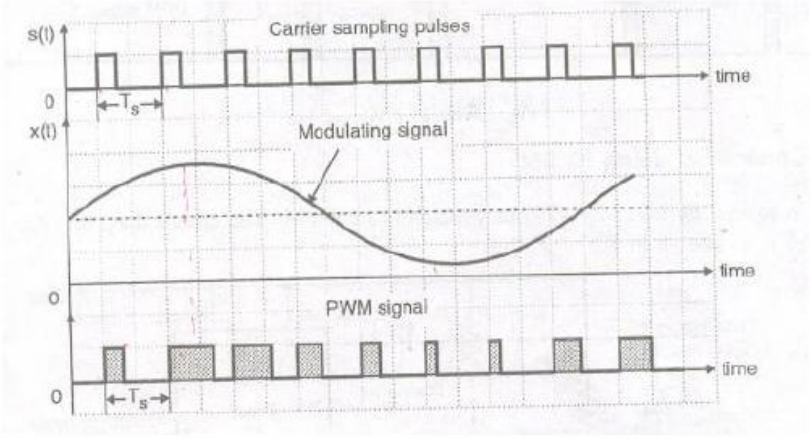
		ii) Full duplex can transmits as well as receives information simultaneously. **Analog Signal:** Analog signal is the signal in which, voltage or current varies continuously with time. **Digital signal:** Digital signal are the discontinuous signals which has only two levels, high and low or one and zero. Example: Data from computers. **Baseband Transmission:** The electrical equivalent of original information is known as the baseband signal. The communication system in which the baseband signals are transmitted directly is known as baseband transmission. **Modulation Technique:** To overcome the drawbacks of baseband transmission and to transmit baseband signals by radio, modulation techniques must be used. **Amplitude Modulation:** The process of modulation in which amplitude of carrier signal is varied in accordance with the instantaneous value of modulating signal keeping frequency and phase of the carrier constant. **Frequency modulation:** The process of modulation in which frequency of carrier signal is varied in accordance with the instantaneous value of modulating signal keeping amplitude and phase of the carrier constant.	
	ii) **Ans.**	**Draw the block diagram for generation of BPSK signal. Draw the waveform of BPSK for bit sequence 10111010.** NRZ encoder counters binary data into NRZ bipolar signal. Consider, the NRZ bipolar signal to be having amplitude +1V corresponding to binary 1 and -1V corresponding to binary 0. The carrier oscillator generates line wave carrier signal ($\sin w_c t$). The product modulator multiplies the i/p encoded signal with the carrier signal producing +1 ($\sin w_c t$) signal and -1 ($\sin w_c t$). The difference of phase between the two signals is 180^0, thus generating BPSK. The band pass filter (BPF) limits the frequency band of BPSK.	**6M** ***Explanation 2M***

MODEL ANSWER

SUMMER – 2018 EXAMINATION

Subject: Communication Technology **Subject Code:** **17519**

		 	***Block diagram 2M*** ***Waveform 2M***
2.	**i) Ans.**	**Attempt any four:** **Define and describe PWM with suitable waveform.** **Block Diagram:** 	**16** **4M** ***Block diagram $1^{1/2}$M***

		Working: The modulating signal is applied to the non inverting terminal of the comparator. A sawtooth generator generates a sawtooth signal of frequency fs. Therefore sawtooth signal is the sampling signal..This is applied to the inverting terminal of the comparator. The comparator output will remain high as the instantaneous amplitude of x(t) is higher than that of ramp signal. This give rise to a PWM signal as the comparator output.  **OR**  	***Explanation $1^{1/2}M$*** ***Waveform 1M***
	ii) Ans.	**Draw the block diagram of FM receiver and explain the working.**	**4M**

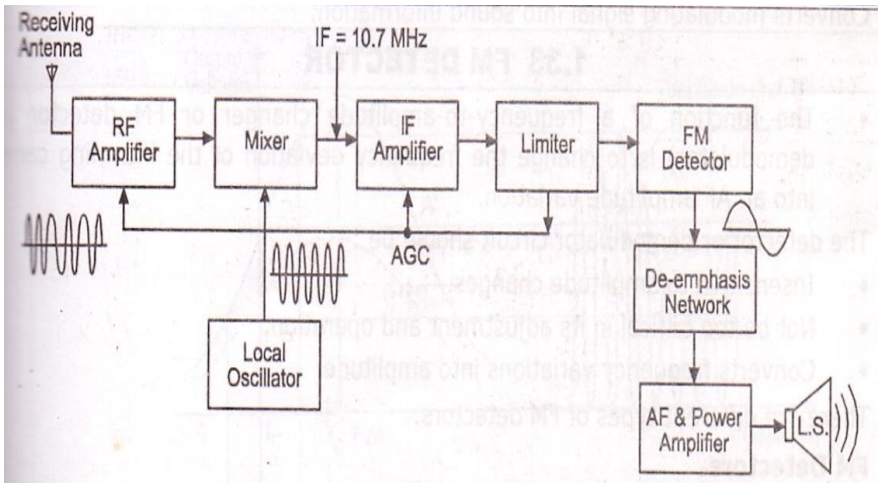


Diagram 2M

Functions: 1. RF Amplifier: Its function is to

- Improve the signal to noise ratio.
- To match the receiver input impedance to antenna impedance.
- To reduce noise figure.

2. Mixer: It is also known as frequency changer. Input signal frequency f_s and local oscillator frequency f_0 are mixed to down convert the received signal to intermediate frequency (IF). IF = f_0 - f_s IF = 10.7 MHz

3. IF Amplifiers: It amplifies the IF of mixer output. Due to large bandwidth, gain per stage is low. Therefore two or more stages of IF amplifiers are used.

4. Amplitude Limiter: It removes the unwanted amplitude that added in original FM signal while travelling in free space. It is removed before demodulation, otherwise distortion appears at the output.

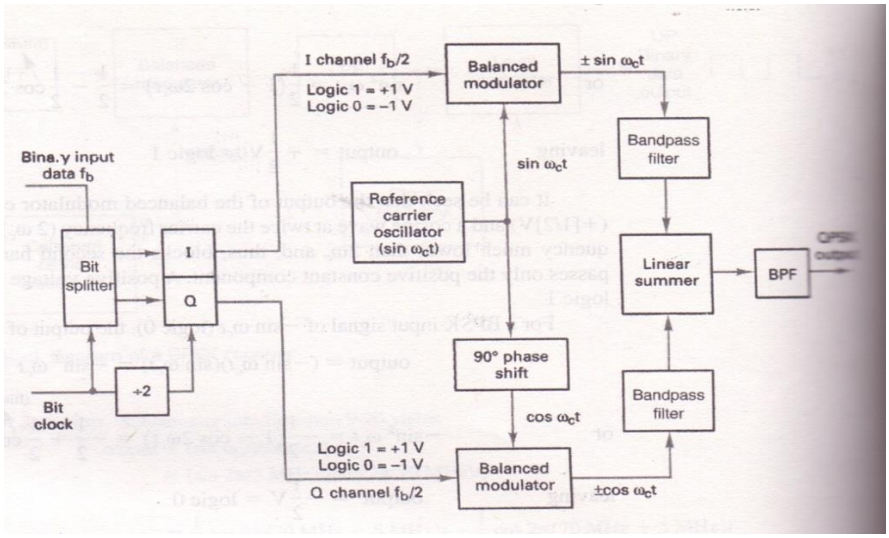
5. FM Detector: It converts the FM signal into original modulating signal.

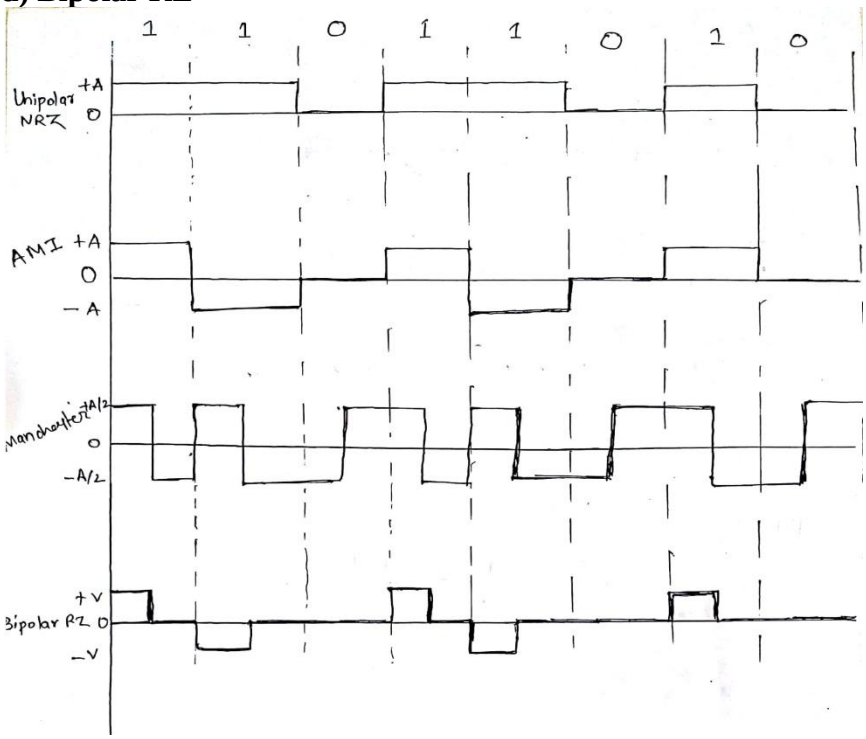
6. De-emphasis: The artificially boosted high frequencies at transmitter are removed by de-emphasis.

7. AF and Power Amplifier: First the modulating signal is voltage amplified and its power is increased to drive the loudspeaker.

8. AGC: Automatic gain control is used to ensure that the signal fit to the limiter is within its limiting range and also prevents overloading of last IF amplifier.

Functions 2M

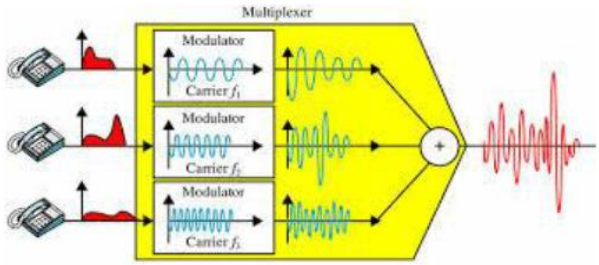
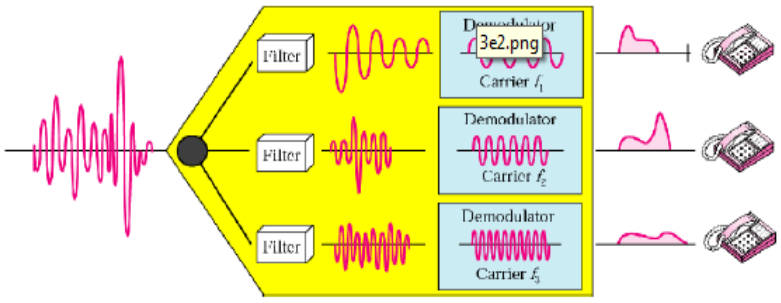
		9. Loudspeaker: It converts modulating signal into sound information.	
	iii) **Ans.**	**Draw the block diagram of QPSK modulator and explain the working.** Quadrature Phase Shift Keying or Quaternary Phase shift Keying 1. QPSK is an example of multilevel phase modulation. 2. With QPSK four output phases are possible for a single carrier frequency. 3. Since four output phases are present, there must be four different input conditions. 4. With two bits there are four possible conditions. 00, 01, 10, 11 are possible. 5. With QPSK the binary input data are combined into groups of two bits called dibits. 6. Each dibit code generates one of the four possible output phases ($+45^o$, $+135^o$, -45^o, -135^o)  1. Two bits (a, dibit) are clocked into the bit splitter. 2. One bit is directed to the I channel and the other to Q channel. 3. The I bit modulates a carrier that is in phase reference oscillator (hence the name "I" for in phase channel). 4. The Q bit modulates a carrier that is 90^o out of phase OR in quadrature with the reference carrier (hence the name "Q" for "quadrature" channel.	**4M** ***Explanation 2M*** ***Block Diagram 2M***

		5. A QPSK modulator is two BPSK modulators combined in parallel. 6. For a logic 1 = + 1V Logic 0 = - 1V Two phases are possible at the output of the I balanced modulator. (+Sin $w_c t$, Sin $w_c t$), and two phases are possible at the output of the Q balanced modulator (+Cos $w_c t$, -Cos $w_c t$). When the linear summer combines the two quadrature (90^o out of phase signals) there are four possible resultant phases given by these expressions: + Sin $w_c t$ + Cos $w_c t$ + Sin $w_c t$ - Cos $w_c t$ - Sin $w_c t$ + Cos $w_c t$ + Sin $w_c t$ - Cos $w_c t$	
	iv) **Ans.**	**Encode the bit stream 11011010 using the following encoding techniques.** **a) Unipolar NRZ** **b) AMI** **c) Manchester** **d) Bipolar RZ**  	**4M** ***Each wave form carry 1M***

MODEL ANSWER

SUMMER – 2018 EXAMINATION

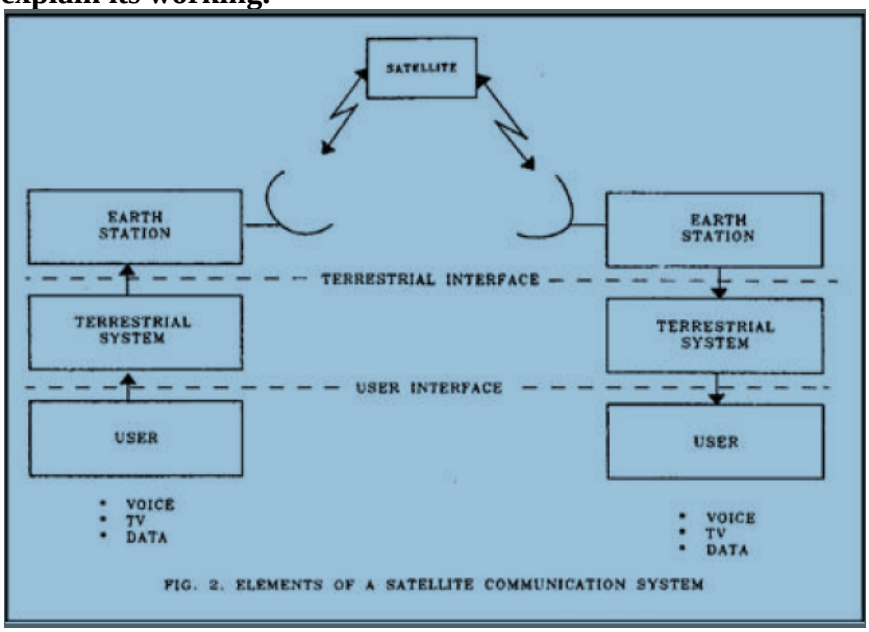
Subject: Communication Technology **Subject Code: 17519**

	v) Ans.	**Draw the block diagram and explain the working of FDM.** In FDM, signal generated by each sending device modulate different carrier frequencies these modulated signal are combined into a single composite signal that can be transported by the link. Carrier frequencies are separated by guard bands to prevent over lapping of signal. Though it is an analog multiplexing system, digital signals can also be sending by continuing them into analog signals. The demux uses a series of filters to decompose the multiplexed signal into its constituent carrier signals these modulated carrier signals are passed through demodulators to separate them from their carrier and then are passed to their output lines**.** **Frequency Division Multiplexing (FDM) Modulation:** **Multiplexing:**  **Demultiplexing:**  	**4M** ***Explanation 2M*** ***Diagram 2M***

MODEL ANSWER

SUMMER – 2018 EXAMINATION

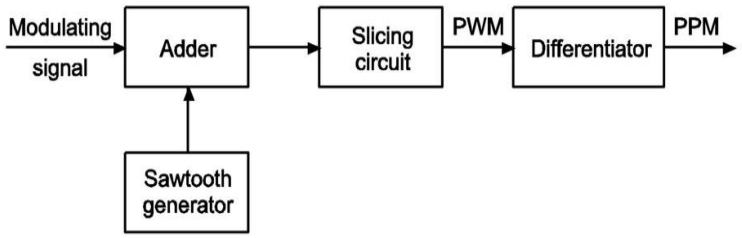
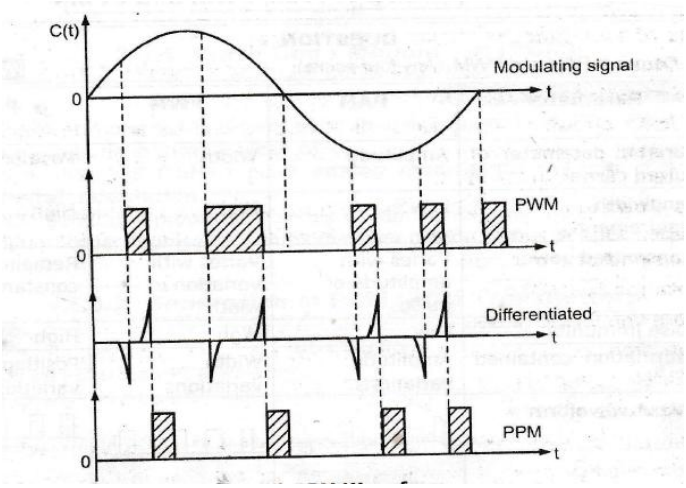
Subject: Communication Technology **Subject Code: 17519**

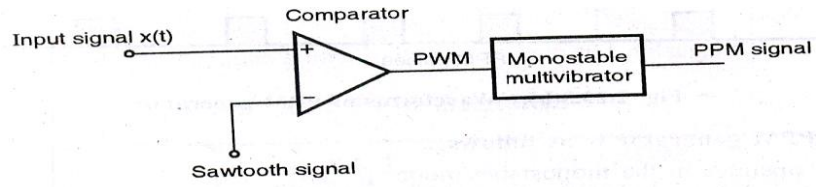
	vi) **Ans.**	**Draw the block diagram of satellite communication system and explain its working.**  FIG. 2. ELEMENTS OF A SATELLITE COMMUNICATION SYSTEM A satellite is any natural or artificial object located in space, capable of receiving and retransmitting electromagnetic waves. **Transmitter:** The satellite communication system consists of a satellite that links many earth stations on the ground. When the user is connected to earth station through a terrestrial network (telephone or leased line) the user generates baseband signal, processes & transmits to the satellite at the earth station. **Satellite:** It is a large repeater in space. It receives the modulated RF carrier in uplink frequency spectrum from all the earth station in the network. The frequency used for transmission from earth station to space (satellite) is called uplink frequency. The satellite amplifies this carrier & retransmits them to the earth in the down link frequency spectrum. The frequency used for transmission from space to earth (satellite to earth station) is called down link frequency. The Uplink & downlink frequency are made different in order to avoid interference of these signal is space. **Receiver:** The earth station receives signal from satellite this signal is processed to get the original baseband signal which is then send to the user through terrestrial network.	**4M** ***Diagram 2M*** ***Explanation 2M***

MODEL ANSWER

SUMMER – 2018 EXAMINATION

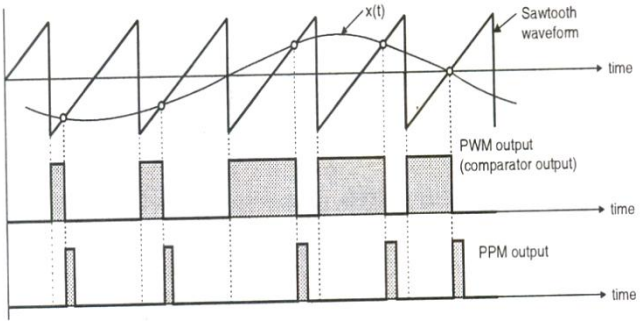
Subject: Communication Technology **Subject Code: 17519**

3.		**Attempt any four:**	**16**
	i)	**Draw the block diagram for generation of PPM. Describe its working with waveform.**	**4M**
	Ans.	**Generation of PPM:**	
			*Diagram 2M*
		Figure: Block diagram of PPM generation	
		Adder: Modulating signal and saw tooth wave gets added here. **Sawtooth Generator:** It generates saw tooth waveform. **Slicing circuit:** The Pulse Width Modulated output will be generated here. **Differentiator:** It is a high pass Filter which gives differential wave and the resultant is PPM.	*Working 1M*
			*Waveform 1M*
		OR	

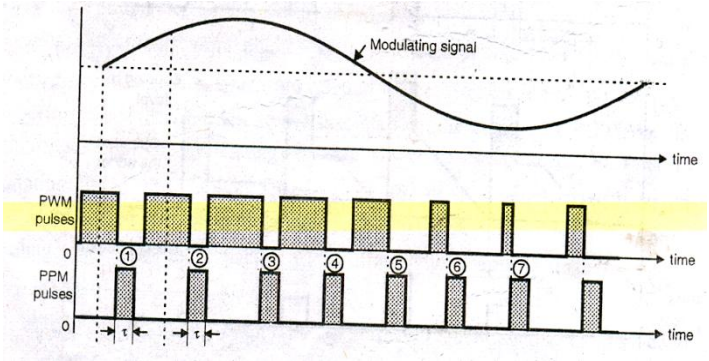


Working Principle:

- A saw-tooth generates a saw-tooth signal which is sampling signal. It is applied to the inverting terminal of the comparator. The modulating signal x(t) is applied to the non-inverting terminal of the same comparator.
- Comparator output will be PWM.
- These PWM signals are fed to mono-stable vibrator, So that every trailing edge of PWM pulses trigger mono-stable vibrator and produce the pulses which is PPM.



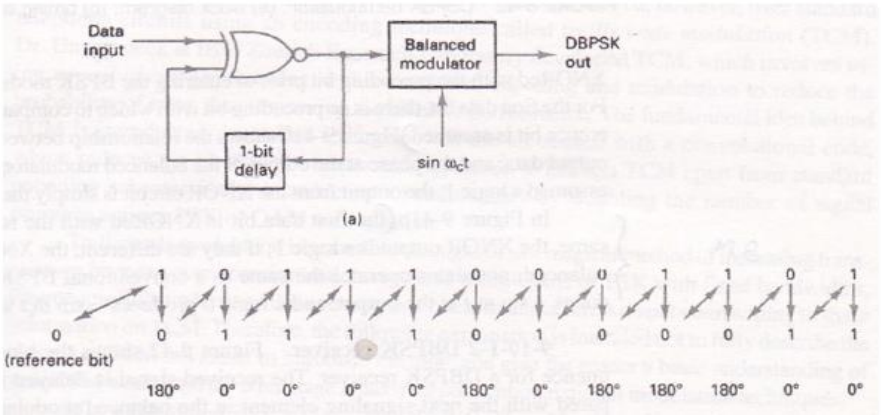
OR



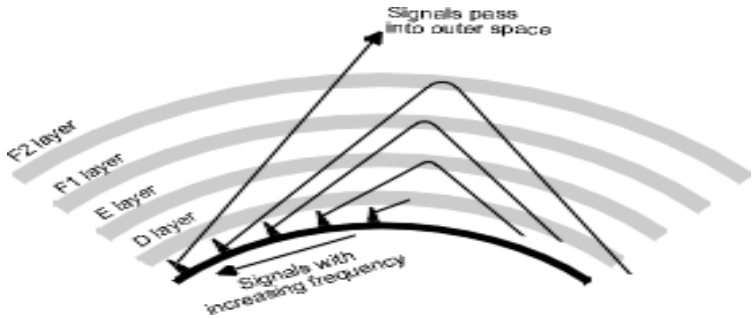
MODEL ANSWER

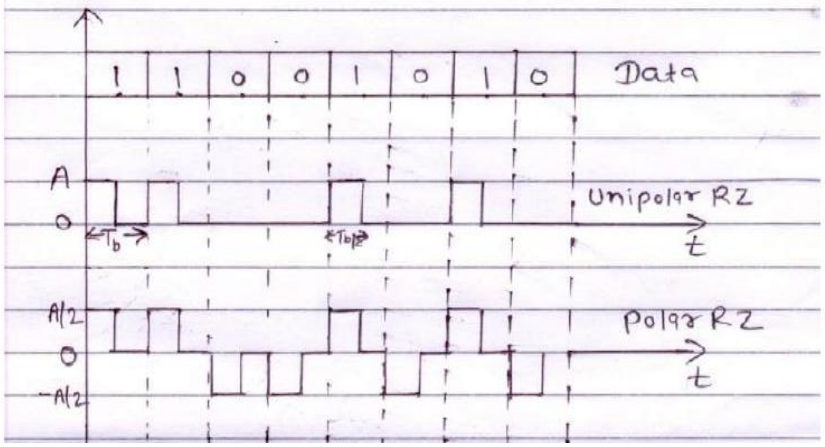
SUMMER – 2018 EXAMINATION

Subject: Communication Technology **Subject Code: 17519**

	ii) **Ans.**	**State Sampling Theorem. Write an equation for Sampling rate and Nyquist rate.** **Sampling Theorem:** In any pulse modulation technique, the sampling frequency should be greater than or equal to twice the maximum frequency of the modulating signal to reconstruct the original information at the receiver with minimum distortion. **Equation for sampling Rate:** fs ≥2 fm **Equation for Nyquist rate:** fs =2fm	**4M** ***Sampling Theorem 2M*** ***Sampling rate 1M*** ***Nyquist rate 1M***
	iii) **Ans.**	**Draw the block diagram of DPSK transmitter state two advantages and disadvantages.**  **Block diagram of DPSK generation** **Advantages of DPSK:** 1) DPSK does not need carrier at its receiver. Hence the complicated circuitry for generation of local carrier is avoided. 2) The bandwidth requirement of DPSK is reduced compared to that of BPSK. **Disadvantages of DPSK:** 1) The probability of error or bit error rate of DPSK is higher than that of BPSK 2) In the DPSK, previous bit is used to detect next bit. Therefore if error is present in previous bit, detection of next be can also go wrong. Thus error is created in next bit also. Thus there is tendency of	**4M** ***Diagram 2M*** ***Any 2 advantages $^{1/2}$M each*** ***Any 2 disadvantages $^{1/2}$M each***

		appearing errors in pain in DPSK. 3) Noise interference in DPSK is more.	
	iv) Ans.	**List two advantages and two disadvantages of polar encoding.** 1. **Polar NRZ:** **Advantages:** • It is simple. • No low-frequency components are present. **Disadvantages** • No error correction. • No clock is present. • The signal droop is caused at the places where the signal is non-zero at 0 Hz. 2. **Polar RZ:** **Advantages:** • It is simple. • No low-frequency components are present. **Disadvantages:** • No error correction. • No clock is present. • Occupies twice the bandwidth of Polar NRZ. • The signal droop is caused at places where the signal is non-zero at 0 Hz. 3. **Manchester:** **Advantages:** • DC component of the signal carries no information. • Transition in middle of bit period provided synchronization. **Disadvantages:** • It needs more bandwidth than other encodings. • Maximum modulation rate is twice NRZ. 4. **Differential Manchester:** **Advantages:** 1. A transition is guaranteed at least once every bit, allowing the receiving device to perform clock recovery. 2. Detecting transitions is often less error-prone than comparing against a threshold in a noisy environment.	**4M** ***Any 2 advantages and disadvantages 2M each***

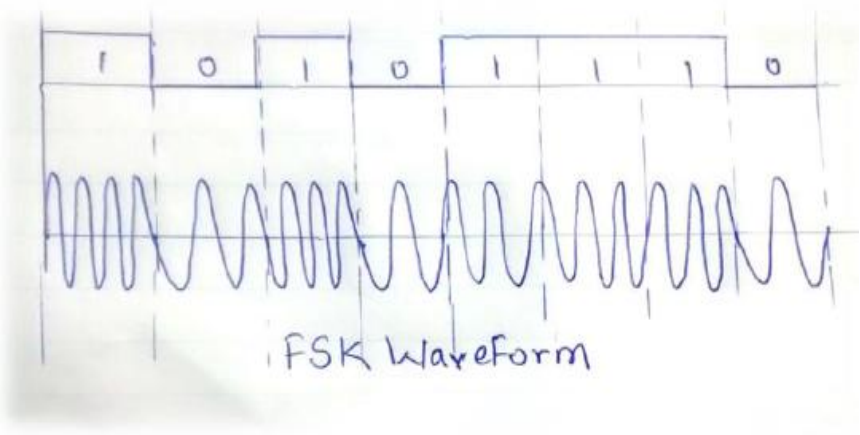
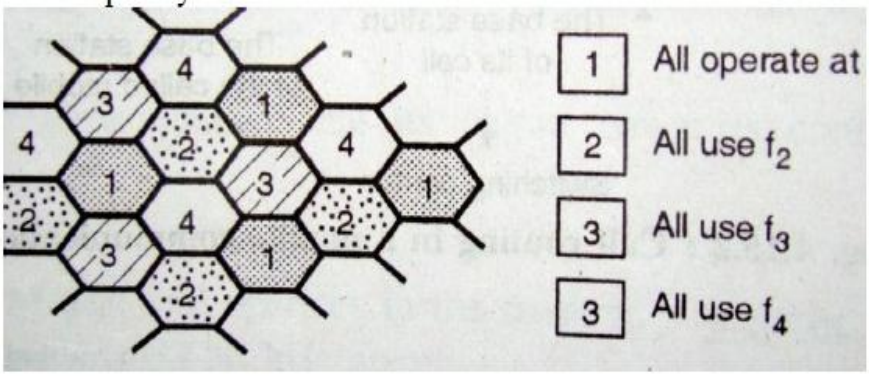
		3. Unlike with Manchester encoding, only the presence of a transition is important, not the polarity. 4. If the high and low signal levels have the same voltage with opposite polarity, coded signals have zero average DC voltage, thus reducing the necessary transmitting power and minimizing the amount of electromagnetic noise produced by the transmission line. **Disadvantages:** • Clock frequency is doubled. • Symbol rate is twice the bit rate of the original signal.	
	v) **Ans.**	**State advantages, disadvantages and application of TDM.** **Advantages of TDM:** 1. We can transmit more number of signals through a single channel. 2. Circuitry in TDM is not as complex as that of FDM. 3. Cross talk problems are not significant. **Disadvantages of TDM:** 1. It is not much suitable for continuous signals. 2. Extra guard time is necessary. 3. Synchronisation is necessary. **Application of TDM:** 1. For the digital transmission of several telephone calls over the same fiber cable in the circuit switched digital telephone network.	**4M** ***Any two advantages and disadvantages 1 ½ M each*** ***Application 1M***
4.	**a)** **i)** **Ans.**	**Attempt any three:** **Explain ionospheric wave propagation with the help of neat diagram.**  	**12** **4M** ***Diagram 2M***

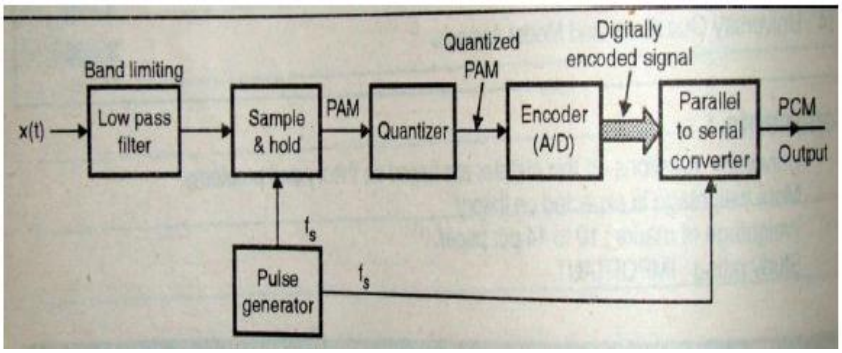
		Electromagnetic waves that are directed above the horizon level are called as sky waves. Typically, sky waves are radiated in a direction that produces a relatively large angle with reference to earth. Sky waves are radiated toward the sky, where they are either reflected or refracted back to earth by the ionosphere. Because of this, sky wave propagation is sometime called as ionospheric propagation. The ionosphere is the region of space located approximately 50km to 400 km above Earth surface. The ionosphere is the upper portion of earth‟s atmosphere. Therefore it absorbs large quantities of the sun radiant energy, which ionizes the air molecules, creating free electrons. When radio wave passes through the ionosphere the electric field of the wave exerts a force on the free electrons, causing them to vibrate. The vibrating electron decreases current, which is equivalent to reducing the dielectric constant. Reducing the dielectric constant increases the velocity of propagation and causes electromagnetic waves to bend away from the regions of high electron density toward regions of low electron density. As the wave moves farther from earth ionization increase; however, there are fewer air molecules to ionize. Therefore, the upper atmosphere has a higher percentage of ionized molecules than the lower atmosphere. The higher the ion density, the more refraction. Also because of the ionosphere's non uniform composition and its temperature and density variations, it is stratified. Essentially, three layers makeup the ionosphere (the D, E, Flayers).	***Explanation 2M***
	ii) **Ans.**	**Draw the waveform for bit sequence given below, ll00l0l0 using unipolar RZ and Polar RZ encoding technique** 	**4M** ***Unipolar RZ 2M*** ***Polar RZ 2M***

MODEL ANSWER

SUMMER – 2018 EXAMINATION

Subject: Communication Technology **Subject Code:** **17519**

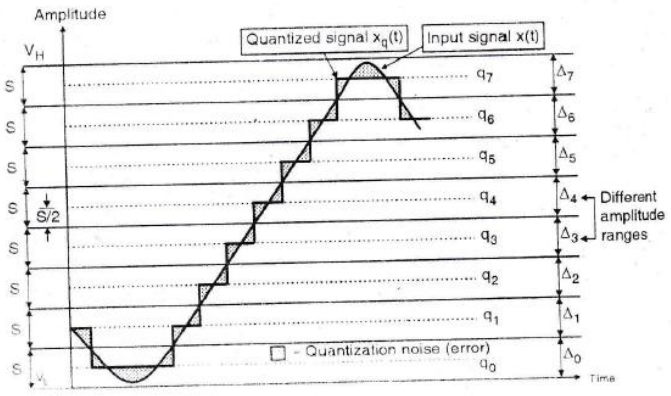
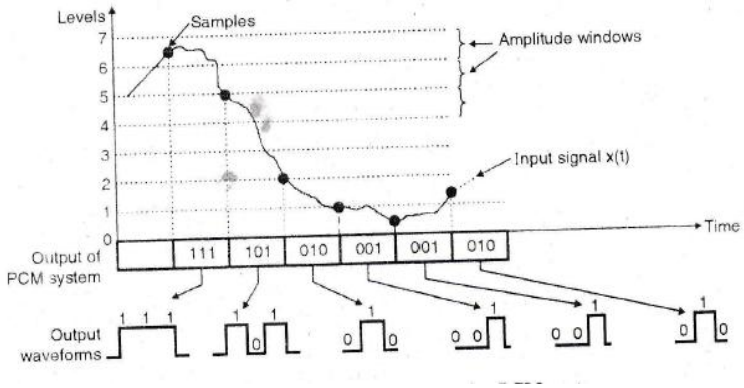
	iii) **Ans.**	**Draw FSK waveform for a given bit sequence 10101110. State its advantages over ASK.**  **Advantages of FSK over ASK:** 1. Low noise, since amplitude is constant 2. Power requirement is constant 3. High data rate 4. Used in long distance communication 5. Easy to decode 6. Good sensitivity 7. It has high security 8. Efficiency is high.	**4M** ***Diagram 2M*** ***Any 4 advantages $^{1/2}$M each***
	iv) **Ans.**	**Describe the concept of frequency reuse.** **Concept of Frequency Reuse**  **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	**4M** ***Diagram 2M***

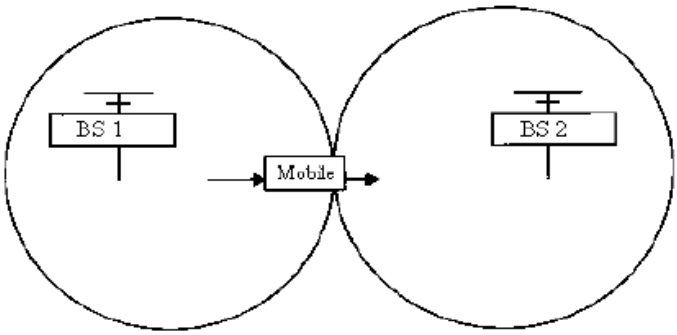
		are separated by sufficient distance reducing each cells coverage area invites frequency reuse cells using the same set of radio channels can avoid mutual interference, provided they are properly separated. Each cell base station is allocated a group of channel frequencies that are different from those 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.	***Description 2M***
4.	**b) i)** **Ans.**	**Attempt any one:** **Draw the block diagram of PCM transmitter. Describe function of each block with waveform.**  **Operation of PCM transmitter:** i. 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. ii. 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. iii. 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.	**6** **6M** ***Diagram 2M*** ***Function 3M***

MODEL ANSWER

SUMMER – 2018 EXAMINATION

Subject: Communication Technology **Subject Code: 17519**

		 iv. 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. v. 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. 	***Waveform 1M***
	ii) **Ans.**	**Describe Handoff mechanism, explain any one type of handoff mechanism.** **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	**6M** ***Description 2M***

		weak as the mobile recedes. Indeed, this ability for transference is a design matter in mobile cellular system design and is call handoff.  **Types of Hand OFF:** 1. Hard Handoff 2. Soft Handoff 3. Queued Handoff 4. Delayed Handoff 5. Intersystem Handoff 6. Intra system Handoff 7. Mobile Assisted Handoff (MAHO) **1. Hard Handoff:** ➢ The definition of a hard handover or handoff is one where an existing connection must be broken before the new one is established. ➢ Hard handoff allocate different frequency of user. ➢ In hard hand off a handset always communicates with one BS at any given time ➢ Hard handoff is typically used in TDMA and FDMA systems. ➢ Hard handoff is not very complicated. ➢ Since the radio link between the BS and the handset is broken before it is connected in hard handoff, the link transfer may fail due to long network response time even if radio channels are available in the new BS. **2. Soft handoff:** ➢ Soft handoff is defined as a handover where a new connection is established before the old one is released.	***Diagram 1M*** ***Any one type 3M***

		➢ Soft hand off allocate same frequency. ➢ In soft handoff a handset may connect up to three or four radio links at the same time. ➢ Soft handoff used in CDMA and some TDMA systems. ➢ Soft handoff is more complicated than hard handoff. ➢ On the other hand, soft handoff degrades channel availability because a handset may consume multiple radio channels. **3. Delayed handoff:** ➢ A Delayed handoff is a two hand off level algorithm. It provides more opportunity for a successful hand off. ➢ The MTSO always handles the handoff first and the originating calls second. If no neighboring cells are available after the second handoff level is reached, the call continues until the signal strength drops below the threshold level then the call is dropped. ➢ Lower handoffs help in handling call processing more adequately. ➢ It makes the hand off occur at the proper location and eliminates possible interference in the system. **4. Queued hand off:** ➢ Queued hand off is more effective than two threshold level handoffs. ➢ The MTSO will queue the requests of handoff calls instead of rejecting them if the new cell sites are busy.. ➢ With Queuing of originating calls only, the probability of blocking is reduced. ➢ It is effective when implementing a simple queue for hand off calls which reduces call drops. **5. Intersystem Handoff:** ➢ If during an ongoing call a mobile unit moves from one cellular system to a different cellular system which is controlled by different MTSO, a handoff procedure which is used to avoid dropping of call referred as Intersystem Handoff takes place. ➢ An MTSO engages in this handoff system when a mobile signal becomes weak in a given cell and MTSO cannot find another cell within its system to which it can transfer the call then in	

progress.

Before implementation of Intersystem Handoff, the MTSO compatibility must be checked and in an Intersystem Handoff a local call may become a long distance call as the mobile moves out of its home system and becomes a roamer in a neighboring system.

6. Intrasystem Handoff:

- If during an ongoing call a mobile unit moves from one cellular system to an adjacent cellular system which is controlled by the same MTSO, a handoff procedure which is used to avoid dropping of call referred to as Intra System Handoff takes place.
  - An MTSO engages in this handoff system when a mobile signal becomes weak in a given cell and the MTSO finds another cell within its system to which it can transfer the call in progress.
  - In Intra System Handoff local calls always remain local calls only since after handoff also the call is handled by the same MTSO.

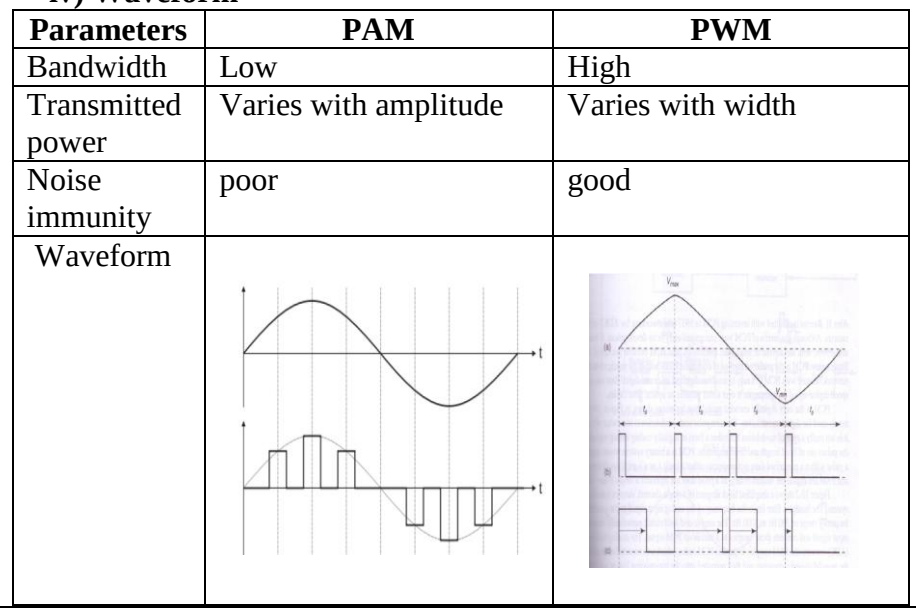
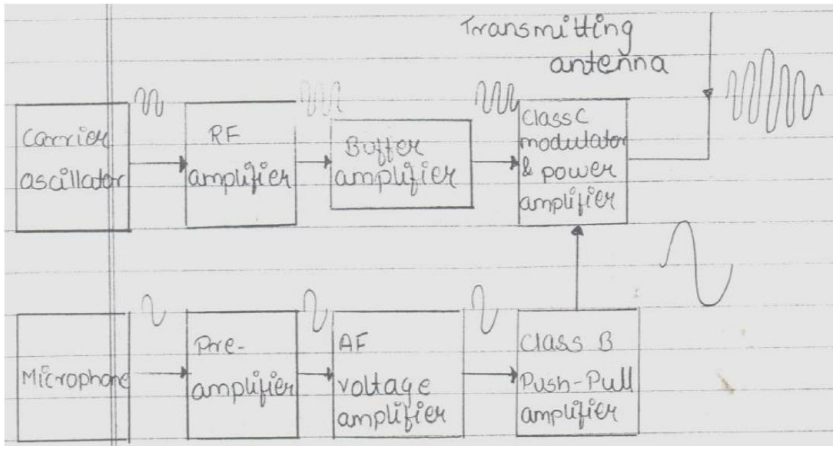
7. Mobile Assisted Handoff (MAHO):

- Every mobile station measures the received power from surrounding base stations and continually reports the results of these measurements to the serving base station.
  - A handoff is initiated, when the power received from the base station of a neighboring cell begins to exceed the power received from the current base station by a certain level or for a certain period of time.
  - In MAHO method call handed over between base stations is much faster than first generation analog systems .As handoff measurements are made by each mobile. MSC no longer constantly monitors signal strengths. MAHO is particularly suited for microcellular environments where handoffs are more frequent. During the course of a call, if a mobile moves from one cellular system to a different cellular system controlled by a different MSC, an intersystem handoff becomes necessary,
- An MSC engages in an intersystem handoff when a mobile signal becomes weak in a given cell and the MSC cannot find another cell within its system to which it can transfer the call in progress

MODEL ANSWER

SUMMER – 2018 EXAMINATION

Subject: Communication Technology **Subject Code:** **17519**

5.	**i)**	**Attempt any four:** **i) Compare PAM, PWM system, with respect to :** **i) Bandwidth** **ii) Transmitted power** **iii) Noise immunity** **iv) Waveform**	**16** **4M**
	Ans.		***Each point 1M***
	ii)	**Draw the block diagram of AM transmitter (low level modulation). Describe its operation.**	**4M**
	Ans.	**Low level AM Transmitter** 	***Diagram 2M***

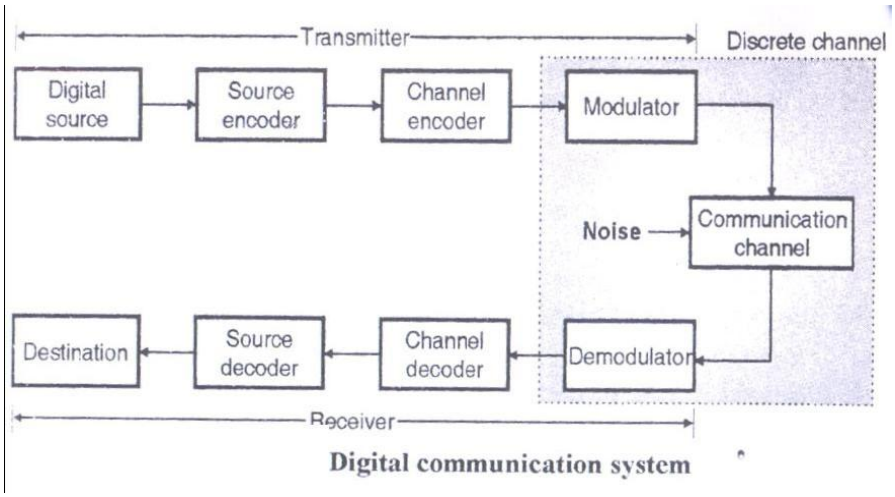
Parameters	PAM	PWM
Bandwidth	Low	High
Transmitted power	Varies with amplitude	Varies with width
Noise immunity	poor	good
Waveform		

		Description: 1. Carrier Oscillator: It consists of LC or crystal oscillator. Its function is to generate a stable and accurate high frequency sinusoidal signal. 2. RF Amplifier: It is a high gain amplifier carrier produced by oscillator. It amplifies RF signal and attenuates other frequencies. 3. Microphone: It is a pick-up device which converts sound signal into voltage in the order of microvolts (μV). 4. Pre-amplifier: The output of the microphone is very weak and is fed to the pre-amplifier. It amplifies the μV to mV level. It is a very sensitive amplifier. 5. AF voltage amplifier: It is a transistorized low frequency amplifier having bandwidth of audio frequency. It amplifies modulating signal from millivolts to volts. 6. Buffer Amplifier: It is an impedance matching circuit. It matches the output impedance of modulator. It is also used as a isolation circuit for isolating RF amplifier with the modulator. 7. AM modulator: It uses either base or emitter modulator. It is a class A or Class B type. The output is AM signal. 8. Class B Push pull amplifier: The modulating signal power required for modulation is very high and hence Class B push pull amplifier is used. 9. Class C modulator & power amplifier: High level transmitter use collector modulation - it is operated in Class C mode to provide very high efficiency. The output modulated wave is directly fed to the transmitting antenna. 10. Transmitting antenna: It converts the modulated signal in electrical form into electromagnetic waves. These waves are transmitted through the atmosphere as ground wave or sky wave to reach the receiver.	***Description 2M***
	iii) **Ans.**	**Draw the block diagram of Digital Communication system state two advantages of it.**	**4M**

MODEL ANSWER

SUMMER – 2018 EXAMINATION

Subject: Communication Technology **Subject Code: 17519**



Digital communication system

Diagram 2M

Advantages:-

1. Better noise immunity
2. Repeaters can be used between transmitter and receiver for regeneration of signals
3. Advanced data processing can be done.
4. Coding can be done that provides security of data /information

Advantages 2M

iv) Compare Baseband and Passband transmission. State the limitation of baseband transmission. **4M**

Ans.

Sr. No.	Baseband transmission	Passband transmission
1.	If the baseband signal is transmitted directly then it is called baseband transmission	If the modulated signal is transmitted over the channel it is called bandpass transmission
2.	Baseband transmission sends the information signal as it is without modulation (without frequency shifting)	Passband transmission shifts the signal to be transmitted in frequency to a higher frequency and then transmits.
3.	Baseband transmission is a Bi-directional transmission	Passband transmission is a Unidirectional transmission.
4.	Baseband transmission is preferred for low frequencies.	Passband transmission is preferred for high frequencies.
5.	Baseband transmission can	Passband transmission can

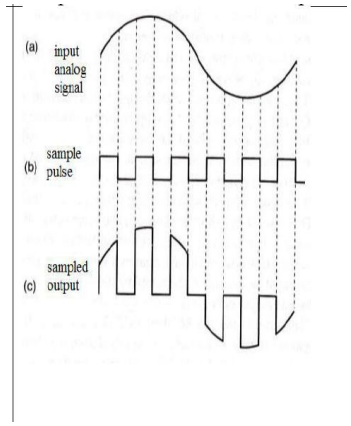
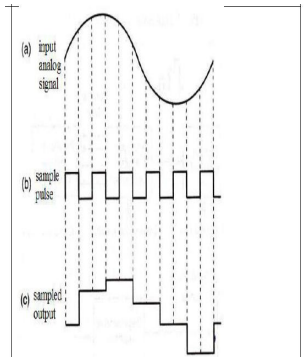
Any 2 comparison 1M each

			travel short distances.	travel long distances.
		6.	Baseband transmission usually used when communicating over wires such as computer data or computer networks.	Passband transmission usually used when communicating over the air transmission such as microwave or satellite link.
		Limitations of baseband transmission: 1. Due to low frequency range, signals cannot travel long distance 2. Doesn't support radio communication 3. Has more effect of noise 4. Can transmit only data and voice		***Any 2 limitations 1M each***
	v) **Ans.**	**State the types of encoding technique. How encoding differs from modulation?** **Encoding techniques are:** 1. Source encoding- PCM, DM, ADM et. 2. Line encoding –Polar, unipolar, bipolar encoding techniques **Difference between modulation and encoding techniques:** Modulation is the process in which the modulating signal or the coded signal is superimposed on a high frequency carrier or the purpose of long distance transmission, whereas encoding is the technique wherein the signals are converted in coded form for the purpose of security and reduce the effect of noise.		**4M** ***Types 2M*** ***Differences 2M***
	vi) **Ans.**	**State the steps for forward and reverse call processing. (Handset to Handset) in mobile communication**. i) After receiving dial tone caller enters mobile no of receiver (or fetches from phone memory) and depresses call button after this no is transmitted through reverse control channel to base station along with callers unique identification. ii) Base station forwards the callers identification no & destination no to MTSO iii) MTSO sends page command to all cell sites controller to locate destination party. iv) Once the destination mobile is located destination cell site controller sends page request trough control channel to destination party to determine if the unit is on or off hook. v) After receiving positive response to the page, ideal user channel are assigned to both mobile units.		**4M** ***Complete procedure 4M***

vi) Call progress tones are applied to both direction (ring & ring back)
vii) When system receives notice that the called party has answered the call switches terminates call progress tone and conversation begins.
viii) If all user channels are busy sends directed retry command instructing caller unit to retry call through neighboring cell.
ix) If system cannot allocate user channel through neighboring cell then switch transmits intercept message to calling mobile unit over control channel.
x) If called party is off hook calling party gets busy signal

6. **i) Ans.** **Attempt any four:** **16**

Compare natural and flattop sampling. **4M**

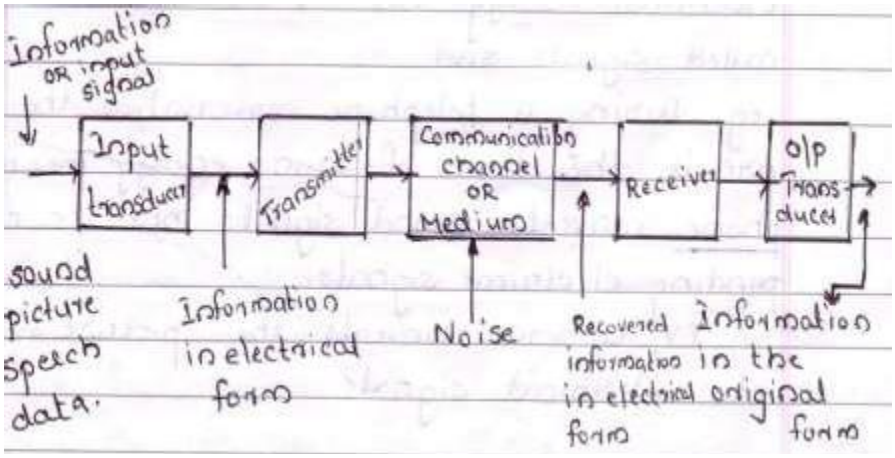
Criteria	Natural sampling	Flattop sampling
Circuit used for generation	Chopper circuit	Sample and hold circuit
Sampled signal	Sampled signal do not have Flat top. Pulses retain natural shape	Sampled signals have flat top.
Waveform		
Shape of the samples	Takes natural shape of modulating signal	Does not take the shape of modulating signal.

Each point 1M

MODEL ANSWER

SUMMER – 2018 EXAMINATION

Subject: Communication Technology **Subject Code: 17519**

	ii) **Ans.**	**Draw basic block diagram of electronic communication system and explain each block.**  **Fig: block diagram of communication system** **The main components of a basic communication system are:** 1. Information or input signal 2. Input transducer 3. Transmitter 4. Communication channel or medium 5. Noise 6. Receiver 7. Output transducer **1. Information or input signal:** The information can be in the form of a sound signal like speech or music or it can be in the form of pictures (T. V. signals) or it can be data information coming from a computer. **2. Input Transducer:** The communication system transmits information in the form of electrical signals. The transducers convert the non-electrical energy into its electrical energy called signals. *E.g.* During a telephone conversation the words are in the form of sound energy. The microphone converts sound signals into its corresponding electrical signals.TV camera converts the picture signals into electrical signals. E.g. Microphone, TV, Camera.	**4M** ***Diagram 2M*** ***Explanation 2M***

3. Transmitter: It is used to convert the information into a signal suitable for transmission over a given communication medium. It increases the power level of the signal. The power level is increased to cover a large range. The transmitter consists of electronic circuits such as amplifier, mixer oscillator and power amplifier.

4. Communication channel or medium: The communication channel is the medium used for transmission of electrical signals from one place to other. The communication medium can be conducting wires cables optical fiber or free space. Depending on the type of communication medium two types of communication systems will exist.
They are
1. Wire communication or line communication
2. Wireless communication or radio communication.

5. Noise: Noise is random undesirable electric energy that enters the communication system through the communication medium and interferes with the transmitted signal.

6. Receiver: The reception is exactly the opposite process of transmission. The received signal is amplified demodulated converted into a suitable form by the receiver. The receiver consists of electronic circuits like mixer, oscillator, detector amplifier etc.

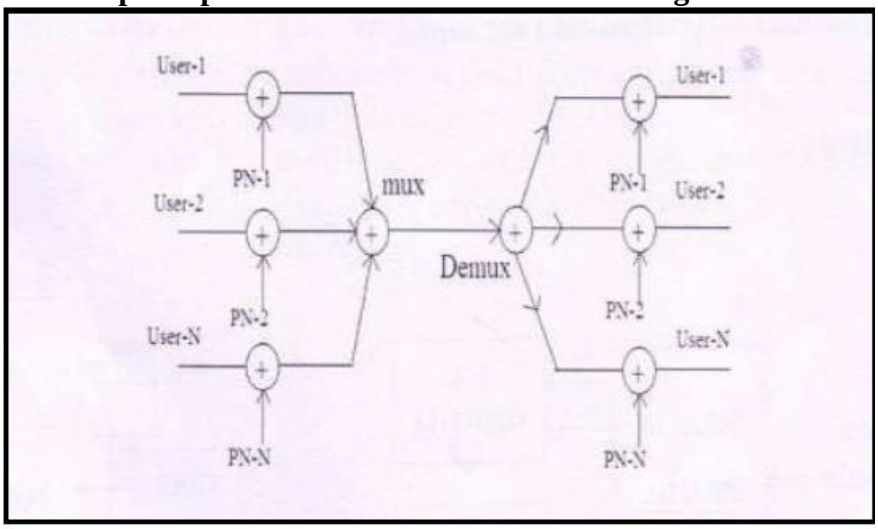
7. Output Transducer: The output transducer converts the electrical signal at the output of the receiver back to the original form is sound or TV pictures etc.
E.g. Loud speaker.

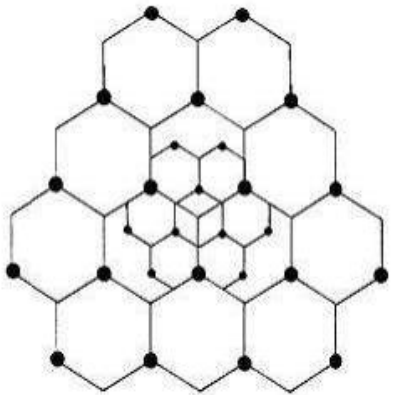
iii) Differentiate between PCM (Pulse Code Modulation) and DM (Delta Modulation). — **4M**

Ans.

Sr. No.	Comparison	PCM (Pulse Code Modulation)	DM (Delta Modulation)
1	Number of bits	It can use 4, 8 or 16 bits per sample	It uses one bit for one sample
2	Levels and step size	The number of levels depends on number of bits.	Step size is kept fixed and cannot be varied

Any 4 differences 1M each

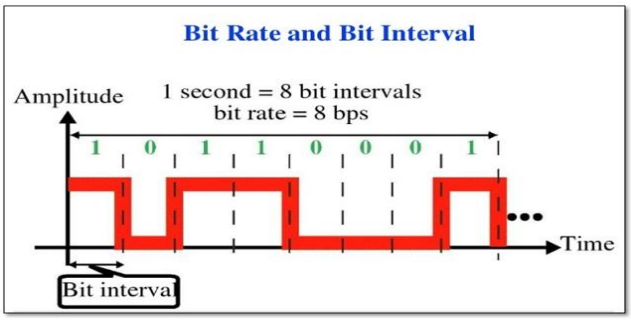
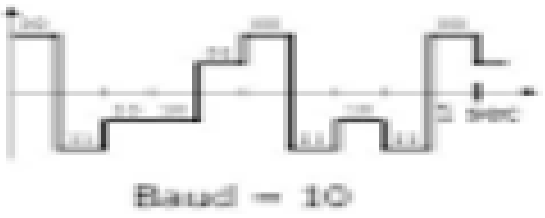
				Level size is fixed.		
			3.	Quantisation error and distortion	Quantisation error depends on the number of levels.	Slope-overload distortion is present
			4.	Bandwidth	Highest bandwidth is needed since no. of bits are high.	Lowest bandwidth is enough
			5.	Feedback	There is no feedback in transmitter or receiver	Feedback exists in the transmitter
			6.	Complexity	Complex system to implement	Simple to implement
	iv) Ans.	**Describe principle of CDMA and state its advantages.**  CDMA system uses same frequency band and transmit simultaneously. They can use the whole available bandwidth for all the time. The transmitted signal is recovered by co-relating the received signal with the PN code used by the transmitter. CDMA allows all the users to occupy all channels at the same time. Transmitted signal is spread over the whole band and each voice or data call is assigned a unique code to differentiate it from other calls carried over the space spectrum. All the users in CDMA use same					**4M** ***Diagram 2M*** ***Description 1M***

		carrier and may transmit simultaneously. Each user has its own pseudorandom code word which is unique for each channel. For detection of message signal the receiver needs to know the code word use by transmitter. Each user operates independently with no knowledge of other users. **Advantages:** 1. Immune to interference 2. Entire bandwidth can be used for every station.	***Any 2 advantages 1/2M each***
	v) Ans.	**Describe the concept of cell splitting and state its need.** **Need:** -Cell splitting means to split up cells into smaller cells. The process of cell splitting is used to expand the capacity (number of channels) of a mobile communication system. As a network grows, a quite large number of mobile users in an area come into picture. Consider the following scenario. There are 100 people in a specific area. All of them owns a mobile phone (MS) and are quite comfortable to communicate with each other. So, a provision for all of them to mutually communicate must be made. As there are only 100 users, a single base station (BS) is built in the middle of the area and all these users' MS are connected to it. All these 100 users now come under the coverage area of a single base station. This coverage area is called a cell. The concept of cell splitting can further be applied to the split cells as well. That is, the split up cells can further be split into a number of smaller cells to improve the efficiency of the BS even more.  **Cell splitting**	**4M** ***Need 2M*** ***Diagram 2M***

MODEL ANSWER

SUMMER – 2018 EXAMINATION

Subject: Communication Technology **Subject Code: 17519**

	vi) **Ans.**	**With the help of example, define:** **i) Bit rate ii) Baud rate** **i) Bit rate:** Bit rate is the number of bits transmitted per second. Data rate is also known as bit rate. Bit rate = **1 /Bit interval** If the bit duration is Tb (known as bit interval), then bit rate will be 1/Tb Bit rate should be as high as possible.  **ii) Baud rate:** Baud rate is the number of signal units or symbols per second. Baud is the unit of signaling speed or modulation rate or rate symbol transmission.  	**4M** ***Each definition 1M*** ***Example with waveform 2M***