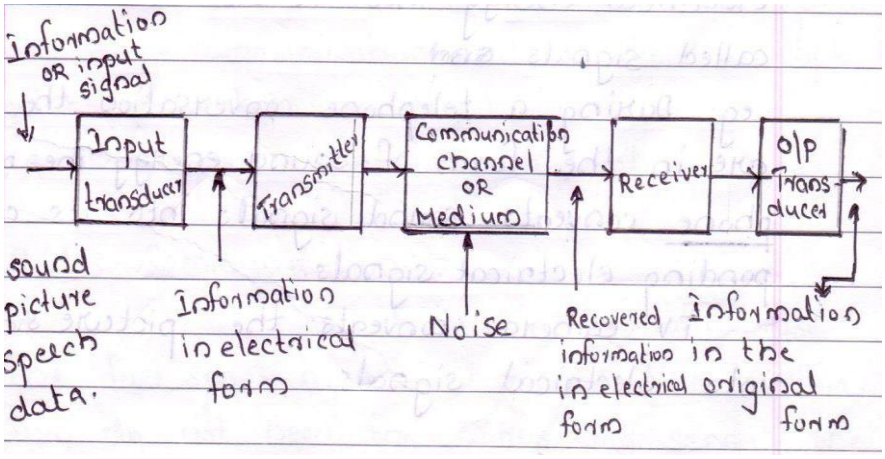
SUMMER – 2019 EXAMINATION
MODEL ANSWER

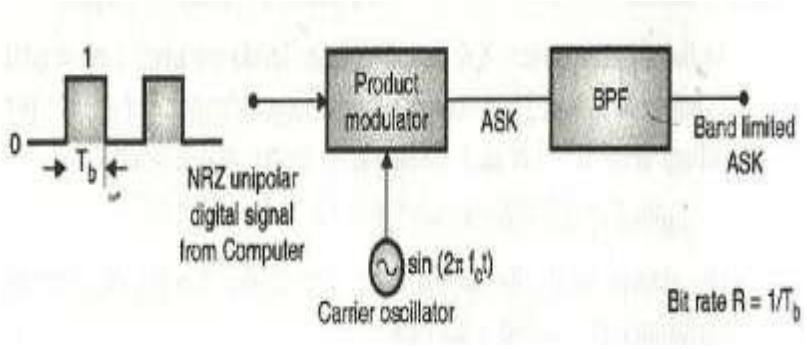
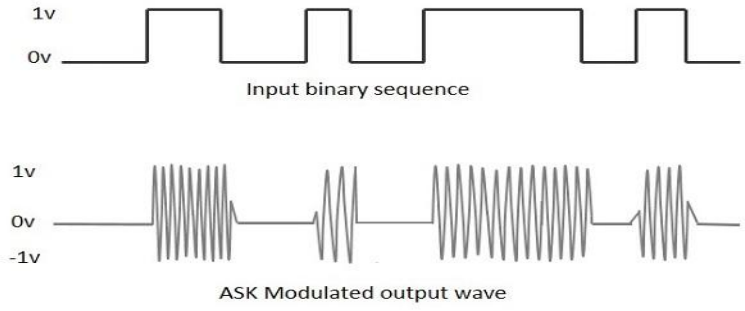
Subject: Communication Technology **Subject Code: 17519**

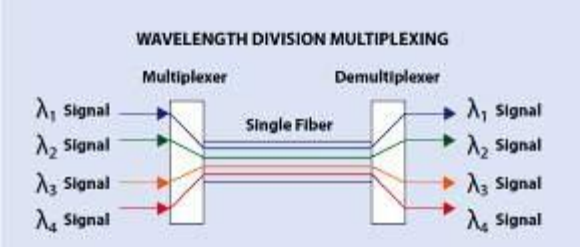
Important Instructions to examiners:

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) (a)** **Ans.**	**Attempt any THREE of the following:** **Draw the block diagram of electronic communication system. State the function of each block.**  **Fig: block diagram of communication system**	**3 x 4 =12** **4M** ***Diagram 2M***

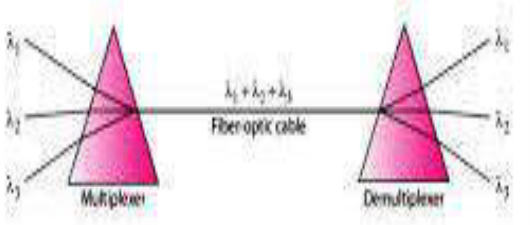
		The main components of a basic communication system are: 1. Information or input signal 2. Input transducer 3. Transmitter 4. Communication channel or medium 5. Noise 6. Receiver 7. Output transducer **1. Information or input signal:** The information can be in the form of a sound signal like speech 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. **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.	***Explanation 2M***

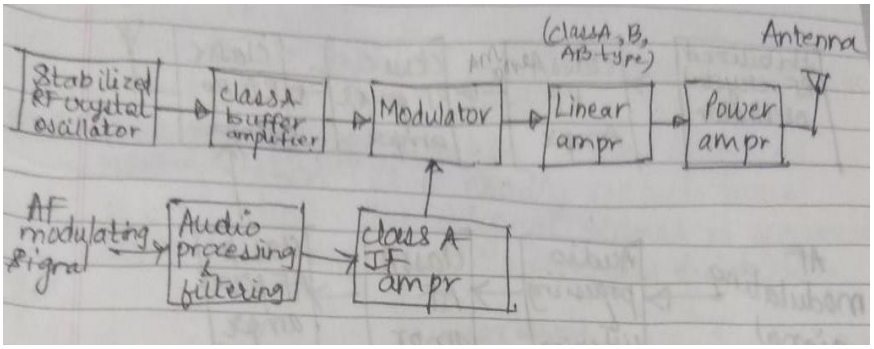
		5. Noise: Noise is random undesirable electric energy that enters the communication system through the communication medium and interferes with the transmitted signal. **6. Receiver:** The reception is exactly the opposite process of transmission. The received signal is amplified demodulated converted 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: electrical signals sound Picture tubes: electrical signals visual data.	
	(b) **Ans.**	**Draw the block diagram to generate ASK. Draw the related waveforms.**  **Block Diagram of ASK Generation**  **ASK waveforms**	**4M** ***Diagram 2M*** ***Waveform 2M***

	(c) Ans.	**Draw a block diagram and explain the principle of WDM.** WDM is an analog multiplexing technique to combine optical signals. • Principle: Very narrow bands of light from different sources are combined to make a wider band of lights & at the receiver, the signal are separated by demultiplexer. • WDM is designed to use the high data rate capability of fiber optic cable. • The optical fiber data rate is higher that the data rate of metallic transmission cable. • Using a fiber optic cable for one single line wastes available bandwidth. • Multiplexing allows us to connect several lines into one. • WDM is conceptually same as FDM, except that the multiplexing & demultiplexing involve the optical signals transmitted through fiber optic cable. • Conceptual view:  Very narrow band of lights of differential wavelengths are combined to make wide band of light. • All wavelength travels through signal cable. • At receiver, the signals are separated by demultiplexer. • Combining & splitting of light sources are easily handled by prism. • Prism bends a beam of light based on angle of incidence & frequency. • Using this technique, multiplexer can be made to combine several input beams of light, each containing narrow band of frequencies into one output beam of wider band of frequencies. • Demultiplexer does reverse process.	**4M** ***Block diagram 2M*** ***Principle of working 2M***

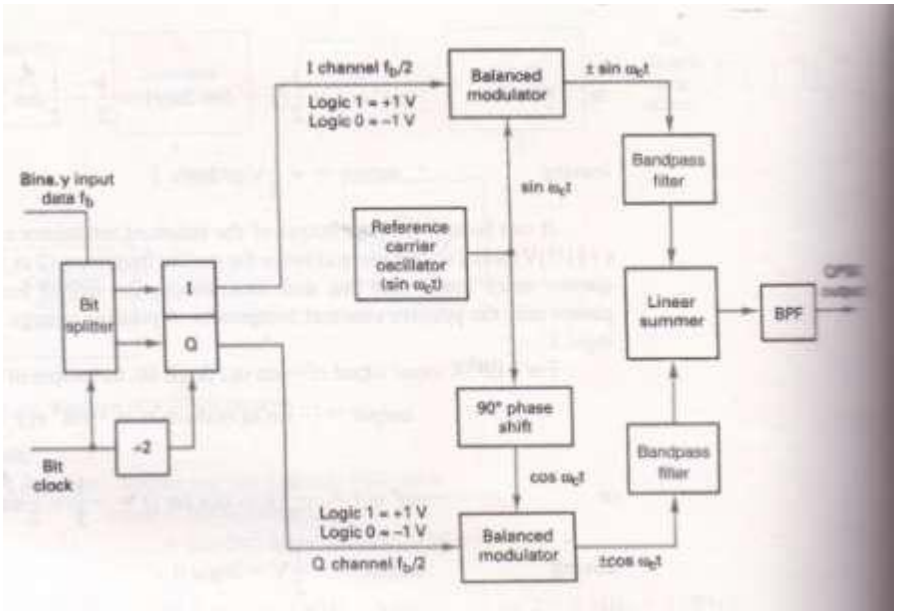
SUMMER – 2019 EXAMINATION
MODEL ANSWER

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

			
	(d) **Ans.**	**An AM transmitter has a carrier frequency of 100 kHz with an amplitude of 6 V. If is modulated to a depth of 60% with signal of 10 kHz. Determine the frequency of the sidebands and the amplitude of the sidebands.** Given: fc=100KHz Vc=6V ma=0.60 fm=10khz Amplitude of sidebands =Vc*ma/2=6*0.60/2=1.8V Frequencies of side bands=fc+fm(USB) =fc-fm(LSB) f(USB)=100+10=110KhZ f(LSB) =100-10=90Khz	**4M** ***2M*** ***1M*** ***1M***
1.	**(B)** **(a)** **Ans.**	**Attempt any ONE:** **Draw the block diagram of AM transmitter (low level modulation) and state the function of various blocks.** Low Level AM transmitter:	**1 x 6 =6** **6M**

		 • RF Oscillator produces the carrier signal. The RF oscillator is stabilized in order to maintain the carrier frequency deviation within a prescribed limit. The carrier frequency is equal to transmitter frequency. • The amplified modulating signal is applied to the modulator along with the carrier. At the output of modulator we get AM wave. • This AM signal is then amplified using a chain of linear amplifiers to raise its power level. • The linear amplifiers can be class A, AB or B type amplifiers. The linear amplifiers are used in order to avoid the waveform distortion in AM wave. • The transistorized modulator circuits can be used for low level modulator due to low power which is to be even led. • The low level transistor does not require a large AF modulator power so its design is simplified. • However the overall efficiency is much lower compared to high level modulation. This is due to use of this efficient linear ampr.	***Block diagram 3M*** ***Explanation 3M***
	(b) **Ans.**	**Draw the block diagram of QPSK generation and describe the working principle.** ***(Note: Even if Waveforms are not drawn, full credits may be given)*** 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 e four different input conditions. 4. With two bits there are four possible conditions. 00, 01, 10, 11 are	**6M** ***Explanation 3M***

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)

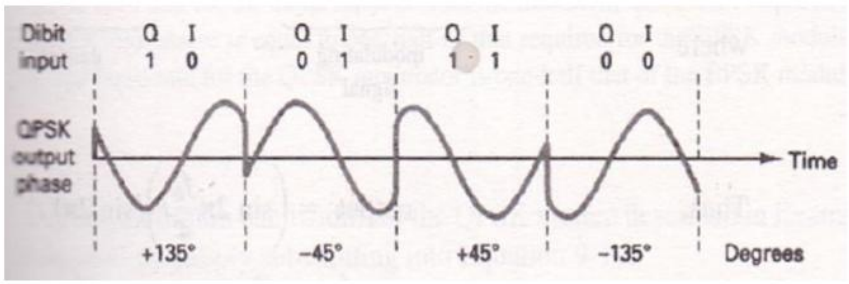


Block diagram 3M

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.
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 wc t, Sin wc t), and two phases are possible at the output of the Q balanced modulator (+Cos wc t, -Cos wc 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 $w_c t$

Output waveform:



Binary input Q	I	QPSK output phase
0	0	−135°
0	1	−45°
1	0	+135°
1	1	+45°

2. **Attempt any FOUR of the following:** **4 x 4= 16**

(a) **Define sampling theorem. Compare natural sampling and flat top sampling with waveforms.** **4M**

Ans. **Sampling theorem:** A continues time signal x (t) can be completely represented in its sampled form and recovered back from its sampled format the receiver with minimum distortion if the sampling frequency $f_s \geq 2w$ ***Definition 1M***

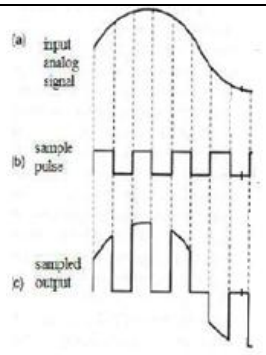
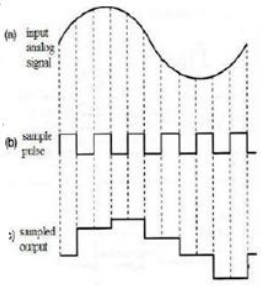
Where fs=Sampling Frequency
w=Maximum modulating frequency

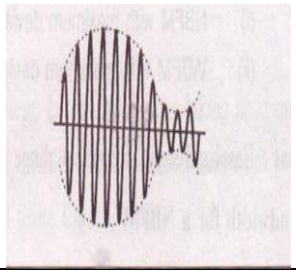
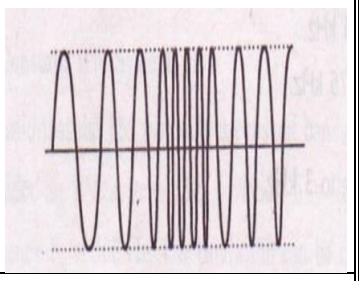
Sr. No.	Parameters	Natural sampling	Flat top sampling
1	Sampling Rate	Sampling rate is greater than equal to Nyquist rate i.e. $f_s \geq 2f_m$	$f_s \geq 2f_m$, satisfies Nyquist criteria.
2	Bandwidth requirement	Increase with reduction in pulse width	Increase with reduction in pulse width

Any three comparison 1M each

SUMMER – 2019 EXAMINATION
MODEL ANSWER

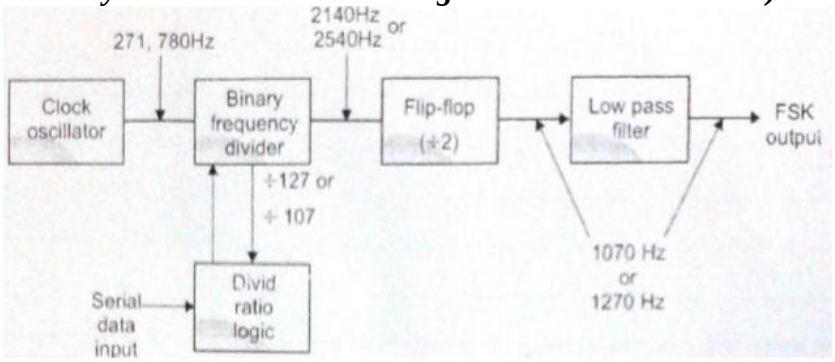
Subject: Communication Technology **Subject Code: 17519**

		3	Signal Power	Increases with increase in pulse width τ	Increases with increase in pulse width τ
		4	Waveform		
	(b)	**Compare AM and FM for the following points:** **(i) Modulation index** **(ii) Bandwidth** **(iii) Nature of waveform in time domain** **(iv) Applications**			**4M**
	Ans.	**Parameter**	**AM**	**FM**	***Each point 1M***
		Modulation index	ma=Vm/Vc where, Vm=Amplitude of modulating signal Vc=Amplitude of carrie signal	mf= Δ/fm where, Δ=frequency deviation fm= frequency of modulating signal	
		Bandwidth	BW =2fm, where fm =frequency of modulating signal	BW=2(Δ+fm) where, Δ= frequency deviation fm = frequency of modulating signal	
		Nature of waveform in time domain	AM wave:	FM wave:	

				
		Applications	Radio & TV broadcasting	Radio & TV broadcasting, point to point communication

(c) **Draw the block diagram to generate FSK signal and explain.** **4M**

Ans. ***(Note: Any other relevant block diagram shall be considered).***



Block diagram 2M

FSK: Frequency shifting keying (FSK) is a digital modulation in which frequency of sinusoidal carrier is shifted between two discrete values of frequency where amplitude & phase remains constant. IN FSK, a binary information signal directly modulates the frequency of analog carrier. Note that binary 1 corresponds to frequency 1270 Hz and binary 0 to frequency 1070 Hz As shown in block diagram.

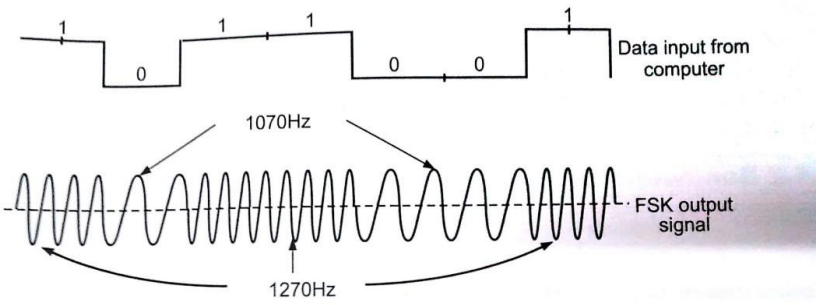
Clock Oscillator: Generates frequency of 271780Hz.

Divide ratio logic: Produces frequency division by 127

Frequency divider: when data input is zero, the frequency divider output will be 1/127 of its input. Then output frequency will be 2140 Hz.

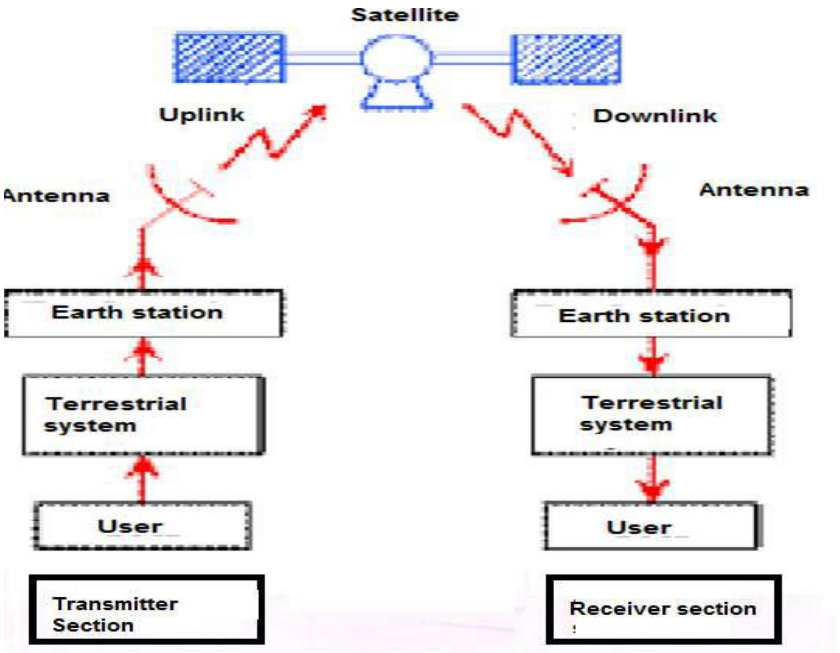
Flip Flop: this divides the 2140 Hz frequency by 2, producing the desired 1070Hz output corresponding to binary '0' similarly, we get

Explanation 2M

		1270 Hz frequency at binary '1' in which frequency divider will divide 107. **Low pass filter:** Removes higher frequency harmonics producing sine wave output. 	
	(d) **Ans.**	**Define:** **(i) bit rate** **(ii) band rate** **(iii) data rate** **(iv) channel capacity** **(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 T_b (known as bit interval), then bit rate will be $1/T_b$ Bit rate should be as high as possible. With increase in data rate the bandwidth of transmission medium must be increased in order to transmit the signal without any distortion. **(ii) band rate:** Baud rate is the number of signal units transmitted per second.. **(iii) data rate:** It is no. of bits transmitted per second. Increasing the no. of bits per sample increases the bit rate which is given as, $D = nfs$ Where D = Data rate in bits per second. fs = Sample rate in samples per second. n = no.of bits are sample. **(iv) channel capacity:** It is defined as maximum data rate at which the digital data can be transmitted over channel reliably.	**4M** ***Each definition 1M***

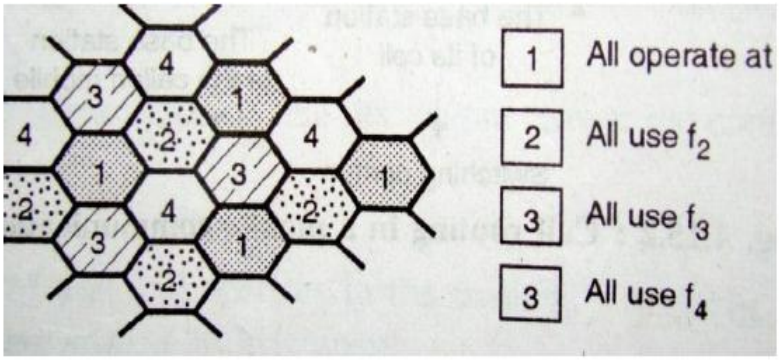
SUMMER – 2019 EXAMINATION
MODEL ANSWER

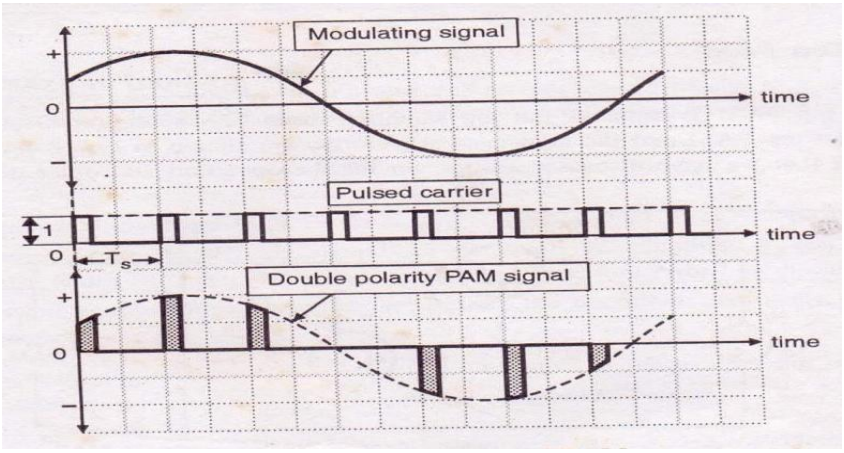
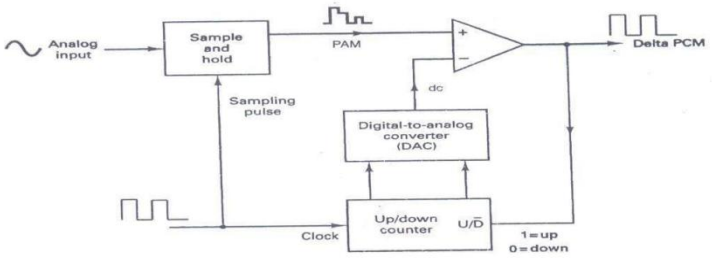
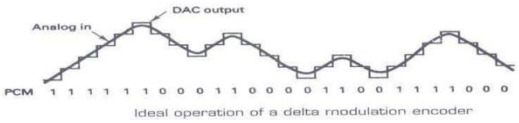
Subject: Communication Technology **Subject Code: 17519**

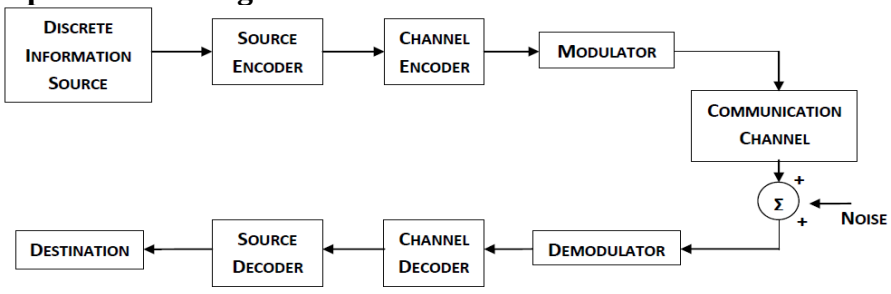
	(e) **Ans.**	**Draw the block diagram of a satellite communication system and state the function of various blocks.**  **Fig: Satellite Communication** **Working principle of satellite communication:** • Users are the ones who generate baseband signals, which is processed at the earth station and then transmitted to the satellite through dish antennas. Now the user is connected to the earth station via some telephone switch or some dedicated link. • The satellite receives the uplink frequency and the transponder present inside the satellite does the processing function and frequency down conversion in order to transmit the downlink signal at different frequency. • The earth station then receives the signal from the satellite through parabolic dish antenna and processes it to get back the baseband signal. • This baseband signal is then transmitted to the respective user via dedicated link or other terrestrial system. • A satellite communication system operates and works in the millimeter and microwave wave frequency bands from 1GHz to 50 GHz.	**4M** ***Diagram 2M*** ***Function 2M***

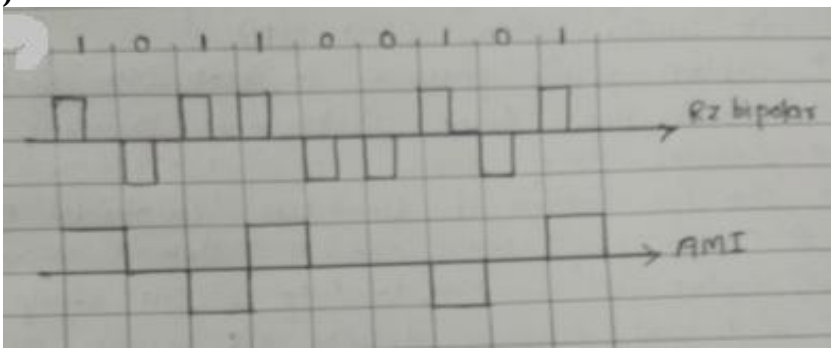
SUMMER – 2019 EXAMINATION
MODEL ANSWER

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

	(f) Ans.	**Explain the concept of frequency reuse in mobile communication.**  **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.	**4M** ***Diagram 2M*** ***Concept of frequency reuse 2M***
3.	**(a) Ans.**	**Attempt any FOUR:** **Draw the waveforms of modulating signal, carrier signal and PAM waveform on same time scale. State two applications of PAM.**	**4 x 4=16** **4M**

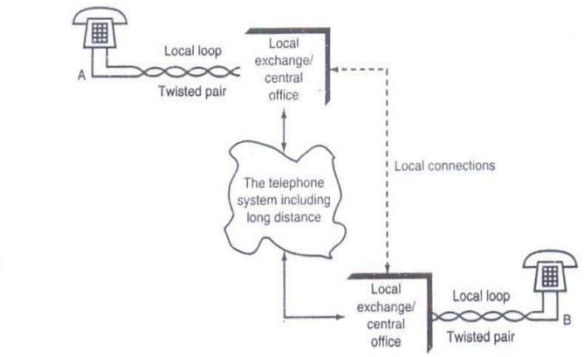
		 **Applications of PAM:** 1. Used in radio telemetry for remote monitoring and sensing. 2. Used as LED drivers. 3. Used in PAM-TDM system. 4. Used in PAM-FM system	*2M for waveform* *Any two correct applications 1M each*
	(b) **Ans.**	**Draw the block diagram of Delta modulation. Describe its working.**  FIGURE 10-20 Delta modulation transmitter  Ideal operation of a delta modulation encoder The above diagram shows a block diagram of a delta modulation transmitter. The analog input is sampled and converted to a PAM signal, which is compared with the output of the DAC. The output of DAC is a voltage equal to the regenerated magnitude of the previous sample, which was stored in the up-down counter as a	**4M** *Diagram 2M* *Description 2M*

		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 sample rate. Therefore, the 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 PAM signal, and compare with zero volts. The output of the 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 a count of 1. The DAC now outputs a voltage equal to the magnitude of the minimum step size (resolution). The steps change value at a rate equal to the clock frequency (sample rate). Consequently, with the input signal shown, the up-down counter follows the input analog signal up until the output of the DAC exceeds the analog sample; then the up-down counter will begin counting down until the output of the DAC drop below the sample amplitude. In the idealized situation, The DAC output follows the input signal. Each time the up-down counter is incremented, logic 1 is transmitted, and each time the up-down counter is decremented, logic 0 is transmitted.	
	(c) **Ans.**	**Draw the block diagram of digital communication system and explain in working.**  **Information source-** it may be in analog forming. Output of microphone gives analog signal. And if source is computer data then it is a digital form. **Source encoder-** the source encoder converts the signal produced by the information source into DataStream. If i/p signal is analog it can	**4M** ***Diagram 2M***

		be converted in to digital form using A to D converter. If the i/p to the source encoder is a stream of symbols it can be converted into a stream of 1s and 0s using some coding mechanism. **Channel Encoder**- if we have to encode the information covertly, even if errors are introduced in the medium. We need to put some additional bits in the source, so that additional information can be used to detect and coolest the errors, this process of adding bits is done by channel encoder. In channel encoding redundancy is introduced so that at the receiving end the redundancy is introduced so that at the receiving end redundant bit can be used for error detection and error correction. **Modulator-** here the modulation is done for transferring the signal, so that the signal I can be transmitted through the medium easily. **Channel**-it is the medium through winch the o/p of modulator along with some noise is transmitted and gives to demodulator. This channel is called discrete channel because its input as well as o/p both are in discrete nature. **Demodulator-** it performs inverse operation than that of modulator. **Channel decoder**- it checks the received bits and also detect and correct the errors, using additional data introduced by channel encoder. **Source decoder**-it converts the bit stream in to actual information, here digital to analog conversion is done if the symbols are coded in to is and os at the source decoder the bits are converted in to symbols.	***Explanation 2M***
	(d) **Ans.**	**Encode the data stream 101100101 with the following encoding techniques:** **(i) RZ bipolar** **(ii) AMI** 	**4M** ***2M for each correct waveform***

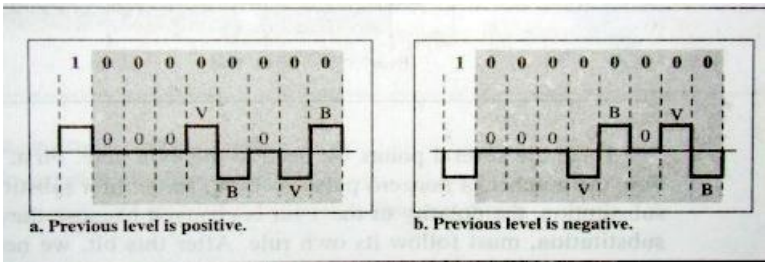
SUMMER – 2019 EXAMINATION
MODEL ANSWER

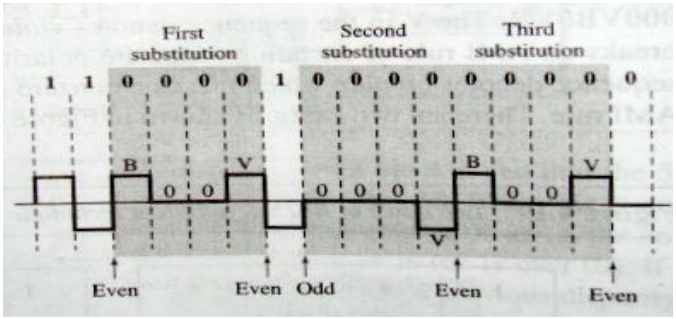
Subject: Communication Technology **Subject Code: 17519**

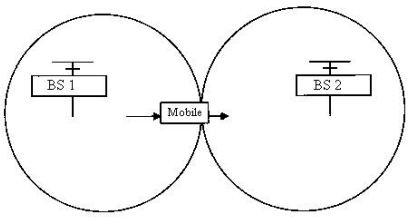
	(e) Ans.	**Draw the block diagram of a telephone system and explain.**  The basic telephone system. The telephone system permits any telephone to connect with any other telephone in the world. This means that each telephone must have a unique identification code- the 10 digit telephone number assigned to each telephone, the telephone system provides a means of recognizing each individual number and switching system that can connect any switching systems that can connect any two telephones. The local loop Standard telephones are connected to then telephone system by way of a two-wire, twisted pair cable that terminates at the local exchange or central office. As many as 10000 telephone line can be connected to single central office. Then connections from then central office go to then "telephone system'. A call originating at telephone A will pass through the central office and then into the main system where it is transmitted via one of many different routes to the central office connected to the desired location designated as B. The connection between nearby local exchange is direct rather than long distance. The two wire twisted pair connection between the telephones and the central office is referred to as the local loop or subscriber loop. All dialing and signaling operations are also carried on this shingle twisted pair. A basic telephones or telephone set is an analog baseband transceiver. It has a handset which contains a microphone and a speaker, better known as a transmitter and a receiver. It also contains a ringer and a dialing mechanism.	**4M** ***Diagram 2M*** ***Explanation 2M***

SUMMER – 2019 EXAMINATION
MODEL ANSWER

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

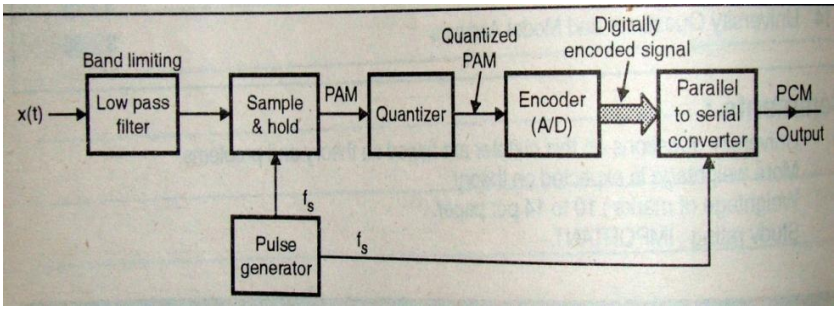
4.	**(A)**	**Attempt any THREE:**	**3 x 4=12**
	(a)	**State four advantages of digital communication over analog communication.**	**4M**
	Ans.	**Advantages of digital communication over analog communication:** 1. Noise immunity increases as coding is possible 2. Multiple data can be send simultaneously using multiplexing 3. More immune to additive noise as digital signals are regenerated rather than amplification in long distance transmission 4. Data encryption is possible 5. Digital signals are simpler to measure and evaluate than analog signals. 6. In digital systems transmission errors can be corrected and detected more accurately.	***Any four advantages 1M each***
	(b)	**Explain B8ZS and HDB3 encoding techniques.**	**4M**
	Ans.	**B8ZS coding scheme (Bipolar with 8 zeroes substitution)**: In this eight consecutive zeroes are substituted by 000VB0VB, the first violation pulse (V) is of the same polarity as the last pulse. Bipulse then follows the inverse polarity rule. The following V is of the same polarity as preceding B pulse. The last B pulse is of inverse polarity. The receiver recognizes the pattern & interprets the octet as consisting of all zeroes. It is also having error monitoring capacity.  a. Previous level is positive. b. Previous level is negative.	***B8ZS 2M***
		HDB3 Code: It is a modification of AMI code & overcomes the problem of long string of binary 0s. If there are more than three consecutive zeros, a violation pulse (V) is substituted for the fourth zero. The violation pulse has the same polarity as the last pulse & it is easily identified at the receiver end. If there is long string of zeros then every fourth pulse will be violation pulse & all violation pulses in string will be of same polarity. To overcome this an additional bipolar (B) pulse to enable	***HDB3 2M***

		detection of violation pulses. Therefore the consecutive four zeros (0000) are substituted by 000V or B00V sequence.  	
	(c) Ans.	**Explain baseband transmission and passband transmission.** **Baseband transmission:** 1. If the baseband signal is transmitted directly then it is called baseband transmission. 2. Baseband transmission sends the information signal as it is without modulation (without frequency shifting). 3. Baseband transmission is a Bi-directional transmission. 4. Baseband transmission is preferred for low frequencies. 5. Baseband transmission can travel short distances. 6. Baseband transmission usually used when communicating over wires such as computer data or computer networks. **Passband transmission:** 1. If the modulated signal is transmitted over the channel it is called bandpass transmission. 2. Passband transmission shifts the signal to be transmitted in frequency to a higher frequency and then transmits. 3. Passband transmission is a Unidirectional transmission. 4. Passband transmission is preferred for high frequencies. 5. Passband transmission can travel long distances. 6. Passband transmission usually used when communicating over the air transmission such as microwave or satellite link.	**4M** ***Baseband Transmission 2M*** ***Passband Transmission 2M***
	(d) Ans.	**Explain Handoff procedure and state its types.** **Handoff:** 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.	**4M** ***2M for handoff Procedure***

		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.  **Two basic types of handoff are defined –** 1.Hard handoff 2.Soft handoff **Hard Handoff:-** With hard handoff, the link to the prior base station is terminated before or as the user is transferred to the new cell‟s base station. That is to say that the mobile is linked to no more than one base station at a given time. Initiation of the handoff may begin when the signal strength at the mobile received from base station 2 is greater than that of base station 1. The signal strength measures are really signal levels averaged over a chosen amount of time. This averaging is necessary because of the Rayleigh fading nature of the environment in which the cellular network resides. A major problem with this approach to handoff decision is that the received signals of both base stations often fluctuate. When the mobile is between the base stations, the effect is to cause the mobile to wildly switch links with either base station. The base stations bounce the link with the mobile back and forth. Hence the phenomenon is called ping-ponging. **OR** **Soft handsoff** :- Soft hand off is defined as a handover where a new connection is established before the old one is released. Soft hand off allocate same frequency. In soft hand off a handset may connect up to three or four radio links at the same time. Soft hand off 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.	***2M for types (1M each for any 2 types)***

SUMMER – 2019 EXAMINATION
MODEL ANSWER

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

4.	**(B)**	**Attempt any ONE:**	**1 x 6=6**
	(a)	**Draw the block diagram of PCM transmitter and state the function of various block.**	**6M**
	Ans.		***Diagram 3M***
		Operation of PCM transmitter: 1. The analog signal x(t) is passed through a band limiting low pass filter, which has a cut-off frequency fc =WHz. This will ensure that x(t) will not have any frequency component higher than "W". This will eliminate the possibility of aliasing. 2. 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. 3.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. 4. 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. 5.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. **Quantization error:** The error between the original analog signal & its quantized version which is measured is called Quantization error.	***Explanation 3M***
	(b)	**Draw the block diagram of mobile communication system and explain the working.**	**6M**
	Ans.		

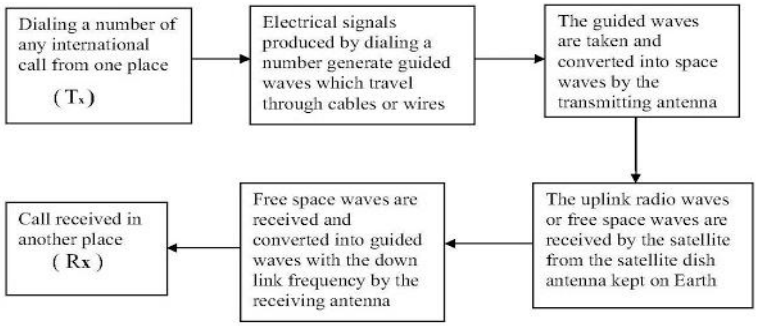


Diagram 3M

Block diagram of mobile communication system

OR

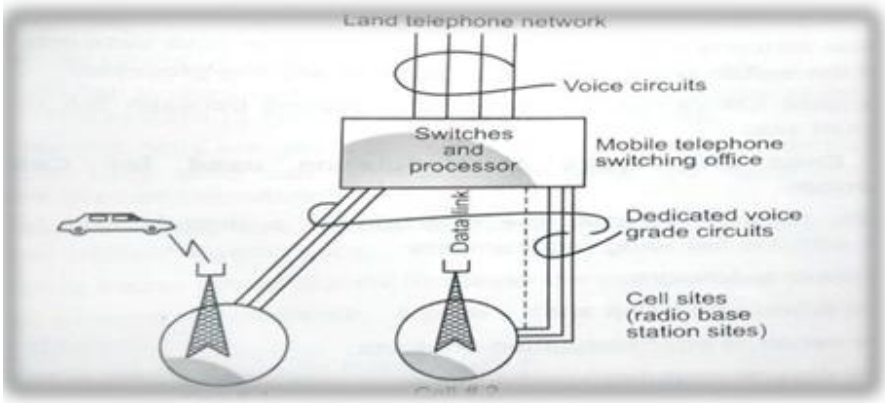


Fig. Cellular Mobile phone System

Figure above shows a cellular mobile phone system which consists of

- Mobile Station (MS)
- Base Station (BS), and
- Mobile Telephone Switching Office (MTSO)

Explanation 3M

Mobile Station (MS): The mobile station contains a transceiver, an antenna, and control circuitry and may be mounted in a vehicle or used as a portable hand-held unit.

Base Station (BS):

The base stations consist of several transmitter and receiver which simultaneously handle full duplex communication and generally have towers which support several transmitting frequency and receiving antennas. The BS serves as a bridge between all mobile users and connects simultaneous mobile calls via telephone lines or microwave links to the MSC.

Mobile Telephone Switching Office (MTSO):
The MSC co-ordinates the activities of all the base stations and connects the entire cellular system to the PSTN. A typical MTSO handles 100,000 cellular subscribers and 5,000 simultaneous conversations at a time, and accommodates all billing and system maintenance functions as well. Communication between the BS and mobiles is defined by a standard Common Air Interface (CAI) that specifies four different channels.

Connections:
The radio and high-speed data links connected the three subsystems. Each mobile unit can use only one channel at a time for its communication link. Each site having multichannel capabilities that can connect simultaneously to many mobile units.

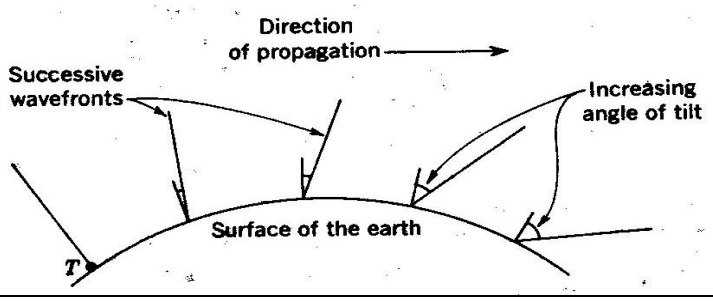
5. **Attempt any FOUR:** **4 x 4=16**

(a) Ans. **Compare PWM & PPM (4 points).** **4M**

Sr. No.	Parameter	PWM	PPM
1	Type of carrier	Train of pulses	Train of pulses
2	Variable characteristic of the pulsed carrier	Width	Position
3	Bandwidth requirement	High	High
4	Noise immunity	High	High
5	Information is contained in	Width variation	Position variation
6	Transmitted power	Varies with variation in width	Remains constant
7	Need to	Not needed	Necessary

Any four points 1M each

			transmit synchronizing pulses		
		8	Complexity of generation and detection	Easy	Complex
		9	Similarly with other modulations systems	Similar to FM	Similar to PM

	(b)	**Explain groundwave propagation with neat diagram. State two features.**	**4M**
	Ans.	**Ground Wave Propagation**: - [up to 2 MHz frequency only] • In this mode of propagation wave is guided along the surface of earth. This propagation will permit propagation around curvature of the earth. Transmitting & receiving antennas are close to the ground. • When surface wave glides over surface of earth, energy is absorbed from surface wave to supply losses in earth. Thus, losses occur due to absorption of energy. • Losses in transmission path also occurs due to diffraction and tilt in wave front. • As wave progresses over the curvature of the earth the wave front stars gradually tilting more and more. Therefore, electric field component becomes parallel to earth surface and field strength goes on reducing and after some distance wave dies. • Transmission distance can be increase by increasing power. • This type of propagation is used for VLF-1and LF band i.e. up to 2 MHz.  	***Explanation with neat diagram 2M***

Features:

- The ground wave propagation is the strongest at the low and medium frequency ranges. The ground wave is the path chosen by the signal when the frequency is between 30 KHz to 3 MHz.
- The ground wave will actually follow the curvature of the earth and therefore can travel a distance beyond the horizon.

Any two features 1M each

(c) Ans. **Compare FM & FSK.** **4M**

Sr. No.	Parameter	FM	FSK
1.	Variable characteristics of the carrier.	Frequency	Frequency
2.	Nature of modulating signal.	Modulating signal is analog.	Modulating signal is digital.
3.	Type	It is a type of Continues Wave modulation.	It is a type of Digital Modulation.
4.	Noise immunity	Better	Better
5.	Application	Radio broadcasting	Low data rate Modem.
6.	Bandwidth	High	High

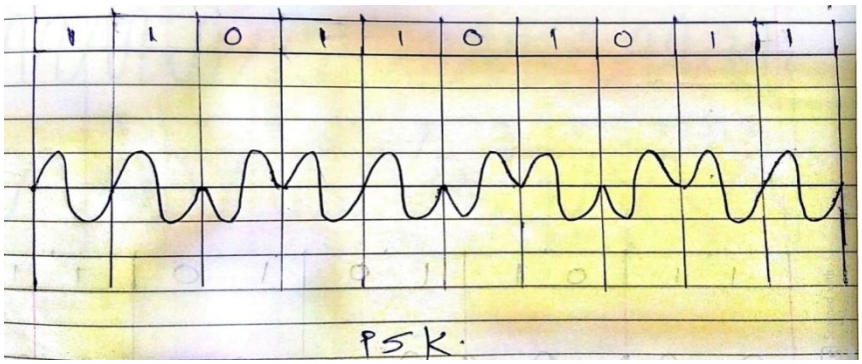
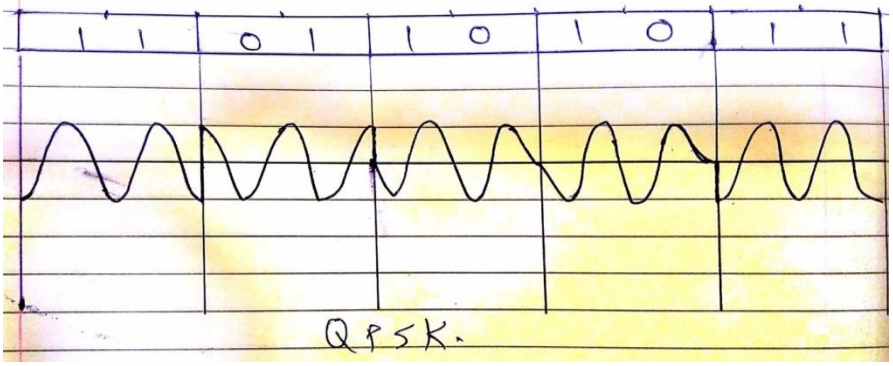
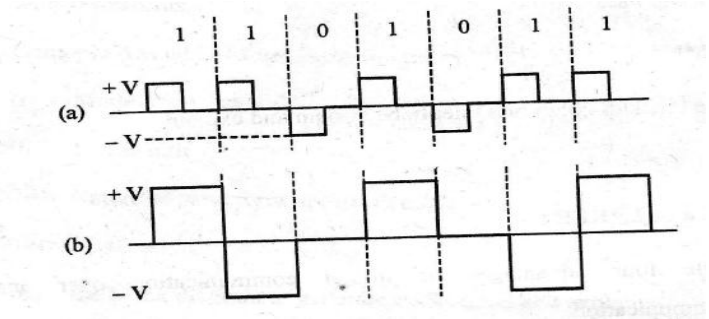
Any four comparison 1M each

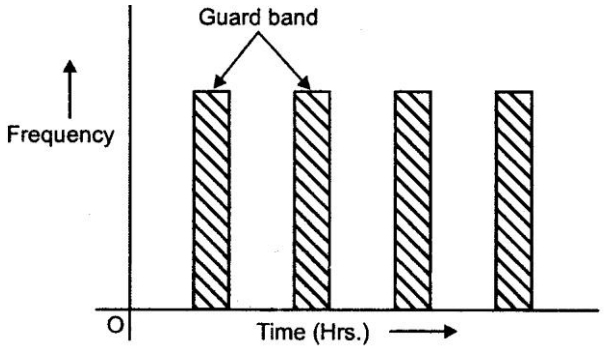
(d) Ans. **For the data stream 1101101011 represent it as** **4M**
(i) ASK (ii) FSK
(iii) PSK (iv) QPSK
ASK and FSK

1M for each bit waveform

SUMMER – 2019 EXAMINATION
MODEL ANSWER

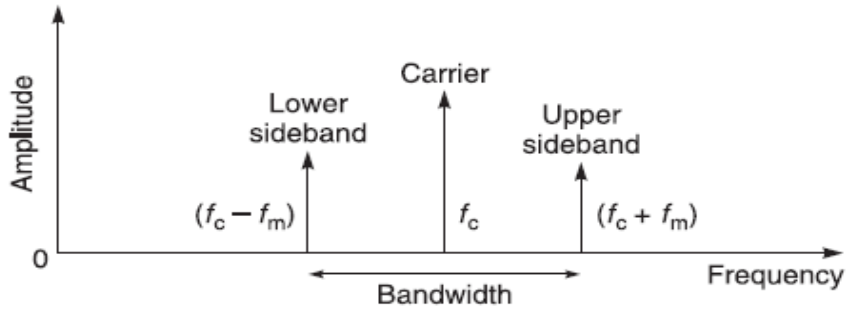
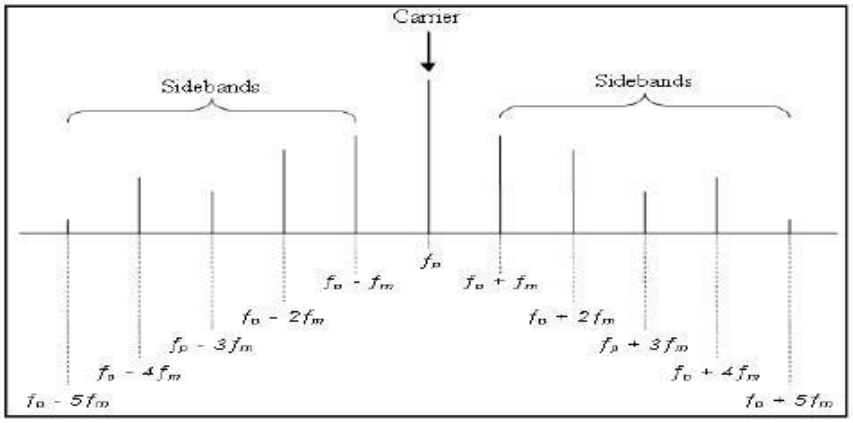
Subject: Communication Technology **Subject Code: 17519**

		PSK  **QPSK**  	
	(e)	**Observe the figures a and b and identify the encoding technique.**  	**4M**
	Ans.	(a) Bipolar RZ (b) Bipolar NRZ(AMI)	***2M for each identification***

	(f) Ans.	**Describe TDMA.** **Time Division Multiple Access (TDMA)** • A method of creating multiple sub channels for multiple access is by subdividing the time duration. • After that each user who wants to transmit information is assigned a particular slot, within each frame. This method is known as time division multiple access TDMA. **Features of TDMA:** • TDMA is used for the transmission of data and digital voice signals. • It is necessary to include "guard times" between the adjacent channels as shown in Fig. • Synchronization is necessary in TDMA. • Power efficiency of TDMA is better than that of the FDMA. • TDMA is a method of time division multiplexing the digitally modulated carriers between various earth stations in a satellite network through a common satellite transponder.  **Advantages of TDMA:** 1. At any instant of time, the carrier from only one station is present at the transponder. This reduces the inter modulation distortion. 2. TDMA is suitable for transmission of digital information. 3. It is possible to store the digital information, changes the rate etc. in TDMA. **Disadvantages:** 1. Precise synchronization is required. 2. Bit and frame timing must be achieved and maintained.	**4M** ***Working 2M*** ***Features 1M*** ***Block diagram 1M***

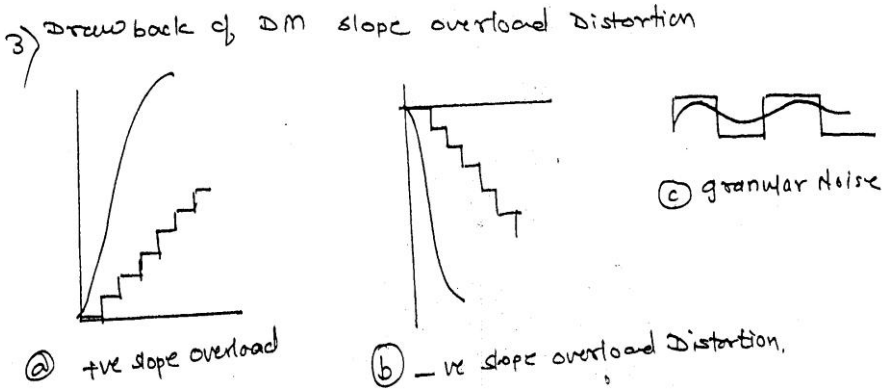
SUMMER – 2019 EXAMINATION
MODEL ANSWER

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

6.	**(a) Ans.**	**Attempt any FOUR:** **State two applications each of PCM & PPM.** **PCM Applications:** • Telephone System • Digital audio recoding • CD laser disks • Voice mail • Digital Video. **PPM Applications:** • In Radio Communication • In Military Applications. • It is also used in Remote controlled aircrafts, cars, boats etc.	**4 x 4=16** **4M** ***Any two applications of PCM & PPM -1M each***
	(b) Ans.	**Draw the labelled frequency spectrum of AM & FM.** **Frequency spectrum of AM:**  **Frequency spectrum of FM:**  	**4M** ***Labelled frequency spectrum of each 2M***

SUMMER – 2019 EXAMINATION
MODEL ANSWER

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

	(c) Ans.	**What are the limitations of DM and explain them.** • Staircase waveform must follow closely to that of modulating signal m(t) then only the recovered signal resemblance to that of the modulating signal. • Fig shows the situation where slope of the modulating signal is greater than slope of staircase signal and therefore error will occur at receiver side while recovering the modulating signal and hence recovered signal at the receiver differs from original modulating signal. This is known as slope overload distortion this will be either positive or negative. • Similarly output of D/A converter will be alternate positive and negative pulses for slowly varying signal and this pulse at the receiver side will generate dc signal instead of slowly varying AC signal. • To avoid this drawbacks or limitations step size of staircase waveform must vary according to modulating signal which generates approximated signal following closely to modulating signal and the system which generates variable step size staircase signal is known as adaptive delta modulation system. 	**4M** ***Any 2 limitations 2M each with waveforms***
	(d) Ans.	**Give four application of satellite communication.** **Applications of satellite communication system** 1) Major application of satellite is surveillance or observation 2) It is used in Navigation (Global Positioning system). 3) It is used in TV distribution(TV signal is transmitted through satellite) 4) Satellite telephone	**4M** ***Any four applications 1M each***

		5) Entertainment - Broadcasting via satellite offers a variety of programming to the avid viewer including local and foreign programs. 6) Do serve civilian in rural area where terrestrial communication network does not exist by providing telephony service. 7) In military sector, providing robust and sophisticated secure communications network. 8) To provide communication when the terrestrial systems fail due to disaster such as earthquake, volcanic eruption floods, drought, cyclones, landslides and epidemics. 9) Tele-medicine.	
	(e) Ans.	**State the sequential steps for handset to handset call procedure.** • While mobile user places the called number into originating register in mobile unit & checks whether number is correct or not & then pushes the send or call button. • This request on selected setup channel is made, cell site receives it & then best directive antennae for voice channel to use are selected. At the same time cell site sends a request to mobile telephone switching office via high speed data link. • On receiving paging command from cell site called users mobile responds to this page, after receiving +ve 'page' from called part cell site assign voice channel to it & instruct each party to tune on that frequency. Call progress tone is send to calling party. • When called party 'Answers' the calling party conversation begins between two mobile users. • If called party out of coverage area of cell sites i.e. When MTSO does not get any +ve page command for called party from any cell site such message is then conveyed to calling party.	**4M** ***Proper procedure 4M***