# *MODEL ANSWER*

## SUMMER– 17 EXAMINATION

**Subject Title: Principles of communication System** Subject Code: 17472

**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 anyequivalent 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 |
|---|---|---|---|
| **Q.1** | **A)** | **Attempt any six :** | **12-Total Marks** |
| | **a)** | **State sampling theorem.** | **2M** |
| | **Ans:** | **Sampling theorem:**<br>State that the sampling frequency (Fs) i.e. number of sample per second should be greater than or equal to twice the maximum frequency component (Fm) of the input signal.<br>Fs $\geq$ 2 Fm<br>**OR**<br>Sampling theorem states that a band limited signal of finite energy having the highest frequency component Fm Hz can be represented and removed completely from a set of samples taken at a rate of Fs samples per seconds provided that<br>Fs $\geq$ 2Fm | **2M** |
| | **b)** | **Give four advantages of satellite communication.** | **2M** |
| | **Ans:** | **Any 4 advantage to be considered**<br>**Advantage :**<br>• It is used for mobile and wireless communication applications independent of location.<br>• It covers wide area of the earth hence entire country or region can be covered with just one satellite.<br>• It co-exists with terrestrial microwave line of sight communication.<br>• It is easy to install and manage the ground station sites.<br>• It is used for voice, data, video and any other information transmission. Satellite | **½ M each** |

| | | | |
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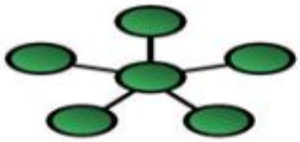
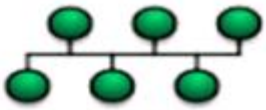
| | | system can be interfaced with internet infrastructure to obtain internet service. It is also used for GPS applications in various mobile devices for location determination.<br>• It is easy to obtain service from one single provider and uniform service is available.<br>• It has small fading margin on the order of about 3dB.<br>• It is used in wide variety of applications which include weather forecasting, radio/TV signal broadcasting, gathering intelligence in military, navigation of ships and aircrafts, global mobile communication, connecting remote areas etc. | |
| **c)** | **The amplitude of carrier varies between 5 V and 1 V. Calculate modulation index.** | | **2M** |
| **Ans:** | Vc + Vm = 5V<br>Vc - Vm = 1V<br>Hence Vc = 3V<br>Vm = 2V<br>Modulation index = m = Vm / Vc = 2 / 3 = 0.66<br>**OR**<br>Vmax =5 V<br>Vmin = 1 V<br>Modulation index = m = Vmax - Vmin / Vmax + Vmin<br>m = 5-1 / 5+1<br>m = 4 / 6 = **0.66** | | **2M** |
| **d)** | **State any two advantages of TDM over FDM.** | | **2M** |
| **Ans:** | • In TDM since only one station is present at any given time so the generation of intermodulation products will not take place.<br>• The entire channel band width can be allowed to a single channel at given instant of time. This is particularly advantageous for the digital channel which demands large bandwidth.<br>• The frequency selective fading does not affect the TDM to extent it affect of FDM.<br>• As only one channel is being transmitted at a time it is not necessary to separate out various channels at the receiver.<br>• TDM by default can work well with the digital therefore it can be easily used for data transmission. | | **2M (Any Two)** |
| **e)** | **Draw a neat sketches of star and bus network topology.** | | **2M** |
| **Ans:** | | | |



STAR Topology



Bus topology

**OR**

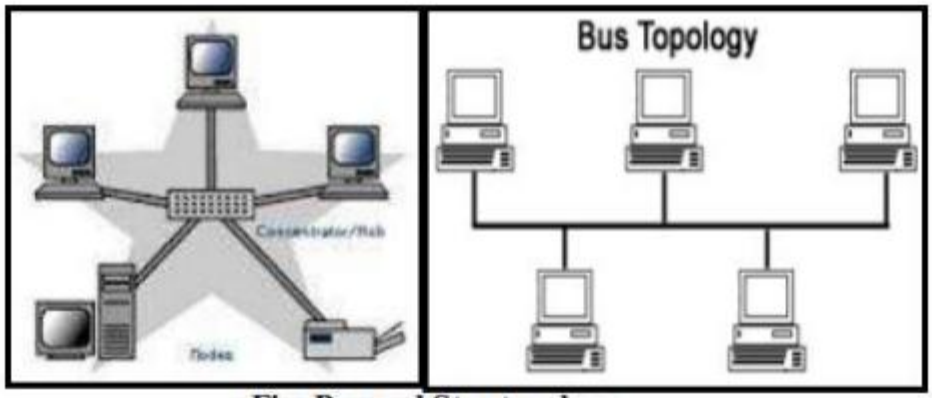



**Fig: Bus and Star topology**

**1M Each**

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| **f)** | **Define: Acceptance angle arid critical angle;** | **2M** |
| **Ans:** | **Acceptance angle**: The maximum value of incident angle for which the incident light can propagate through the fiber to the far end is called the acceptance angle.<br><br>**Critical angle:** The critical angle is the angle at which a radio wave must hit the ionosphere to reflect back to the Earth**.** | **(1M Each)** |
| **g)** | **What is multiplexing? State its types.** | **2M** |
| **Ans:** | **Multiplexing :**<br>Multiplexing is the set of techniques that allows the simultaneous transmission of multiple signals across a single data link.<br><br>**Type of Multiplexing: (Any 2)**<br>a) TDM: Time division Multiplexing<br>b) FDM: Frequency division Multiplexing<br>c) WDM: Wave division multiplexing | **1M**<br><br>**1M** |
| **h)** | **Compare between AM and FM (any 2 points).** | **2M** |
| **Ans:** | | **1M (Any Two Points)** |

| Parameter | AM | FM |
|---|---|---|
| Technique | The amplitude of the carrier wave is varied in proportion to the waveform being transmitted | The Frequency of the carrier wave is varied in proportion to the waveform being transmitted. |

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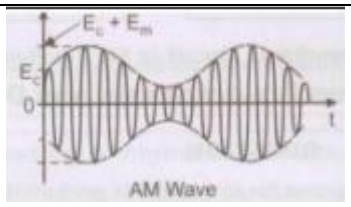
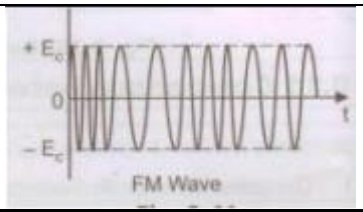
| Bandwidth | 2fm | 2(δ + fm(max)) | |
| Noise Immunity | Less | More | |
| Modulation Index | m= Vm / Vc | $M_f = \Delta fc / fm$ | |
| Waveform |   |   | |

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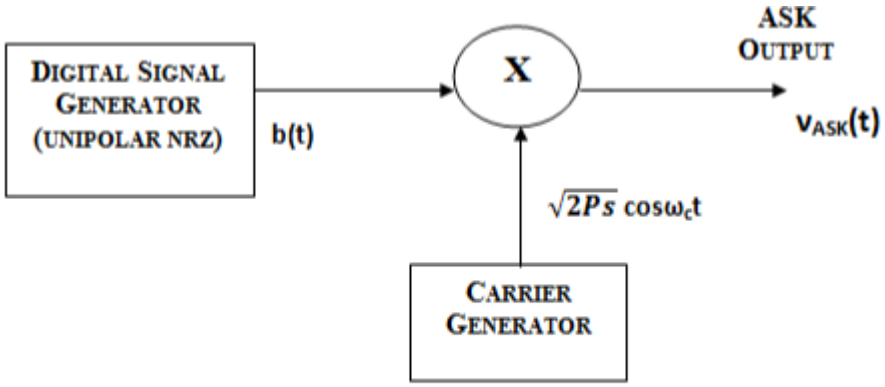
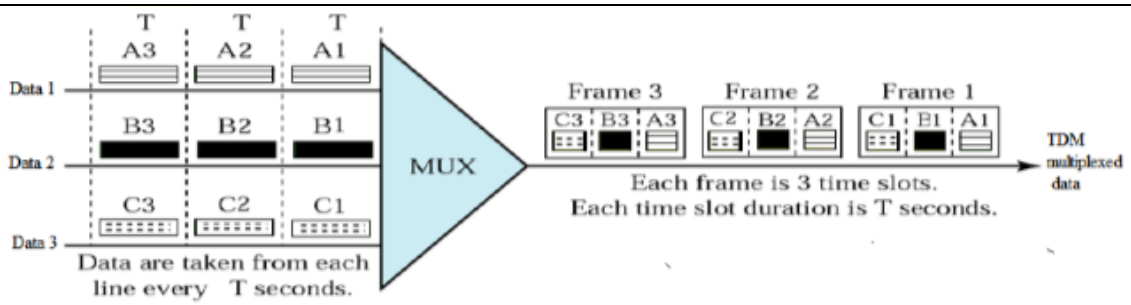
| **B)** | **Attempt any Two :** | **8M** |
| **a)** | **Describe the generation of ASK in brief.** | **4M** |
| **Ans:** | **Diagram :**   *ASK Transmitter* | **2M** |
| | **Explanation :**<br>• The ASK technique of binary modulation is illustrated in Figure 3.1 where modulating signal consists of unipolar pulses.<br>• Because in this case the carrier is switched ON and OFF, this method is also known as ON OFF keying.<br>• For the entire time the binary input is high, the output is a constant amplitude, constant frequency signal and for the entire time the binary input is low, the carrier is off. | **2M** |
| **b)** | **Describe TDM with suitable block diagram.** | **4M** |
| **Ans:** | ***Note:Any relevant diagram should be considered.***<br>**Diagram :** | **2M** |




**OR**

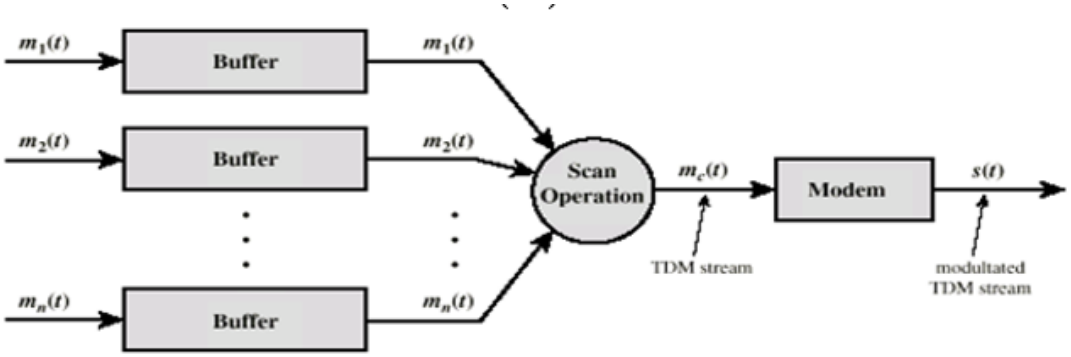



Fig: TDM Transmitter

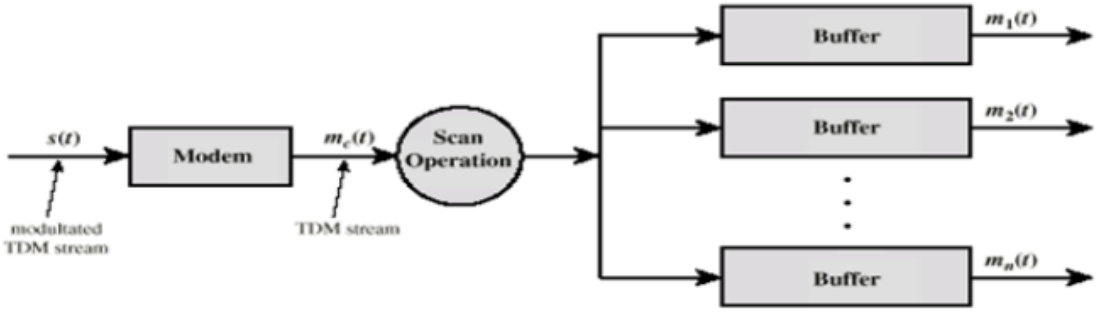



Fig: TDM Receiver

**Explanation :**

- Process of combining digital signals from several sources whereby each connection occupies a portion of time in the link is called Time Division Multiplexing (TDM). **2M**
- Links are sectioned by time rather than frequency.
- Data flow of each connection is divided into units.
- In TDM data units from each input connection is collected in to a frame i.e link combines one unit of each connection to make a frame.
- If we have “n” connection a frame is divided in to “n” time slots and one slot is allowed for each unit. i.e. n input connections , n time slots.
- One for each input line, if the duration of input is T, the duration of each slot is T/n and the duration of each frame is T.
- Data rate of link must be n times the duration of a time slot to guarantee flow of data.

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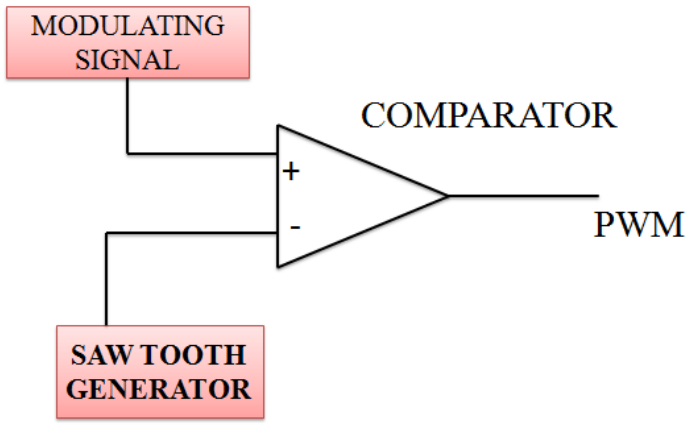
| | | • Time slots are grouped into frames; one complete cycle of time slots; each slot dedicated to one device.<br>• A simple TDM process for three different data transmission is shown above. Here, all three data are divided into equal timeslots also called as units<br>• And each data unit from all three data are combined / multiplexed together to form TDM frames comprising of small units of all three data which is further transmitted. | |
| | **c)** | **What is modulation? 'What is the need of modulation?** | **4M** |
| | **Ans:** | **Modulation :**<br>Modulation is defined as the process by which some characteristic of a carrier wave is varied in accordance with the message signal.<br>**Need of modulation :**<br>• Reduce height of the antenna.<br>• Avoid mixing of signals.<br>• Increases range of communication.<br>• Easy to Multiplex.<br>• Improve quality of reception.<br>• Channel Selectivity.<br>• Improved Signal to Noise Ratio.<br>• Less Fading of transmitted signal. | **2M**<br><br><br><br><br>**2M**<br>**(Any Two)** |
| **Q 2** | | **Attempt any four :** | **16M** |
| | **a)** | **Draw and describe the block diagram of generation of PWM.** | **4M** |
| | **Ans:** | **Diagram :**<br>  <br><br>**Explanation :**<br>• A saw-tooth generates a saw-tooth signal which is sampling signal.<br>• It is applied to the inverting terminal of the comparator.<br>• The modulating signal x(t) is applied to the non-inverting terminal of the same | **2M**<br><br><br><br><br><br><br><br><br><br><br><br>**2M** |

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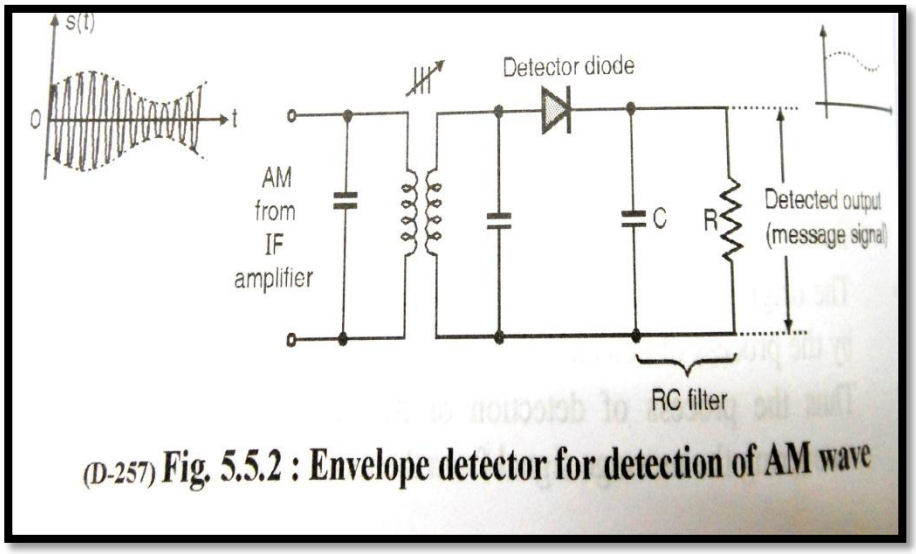
| | comparator.<br>• The comparator compares both the signal whereever the modulating signal is high then the saw tooth the output will be high .Comparator output will be PWM. | |
| **b)** | **Draw and describe simple diode detector with input and output waveforms** | **4M** |
| **Ans:** | **Diagram :** | **2M** |

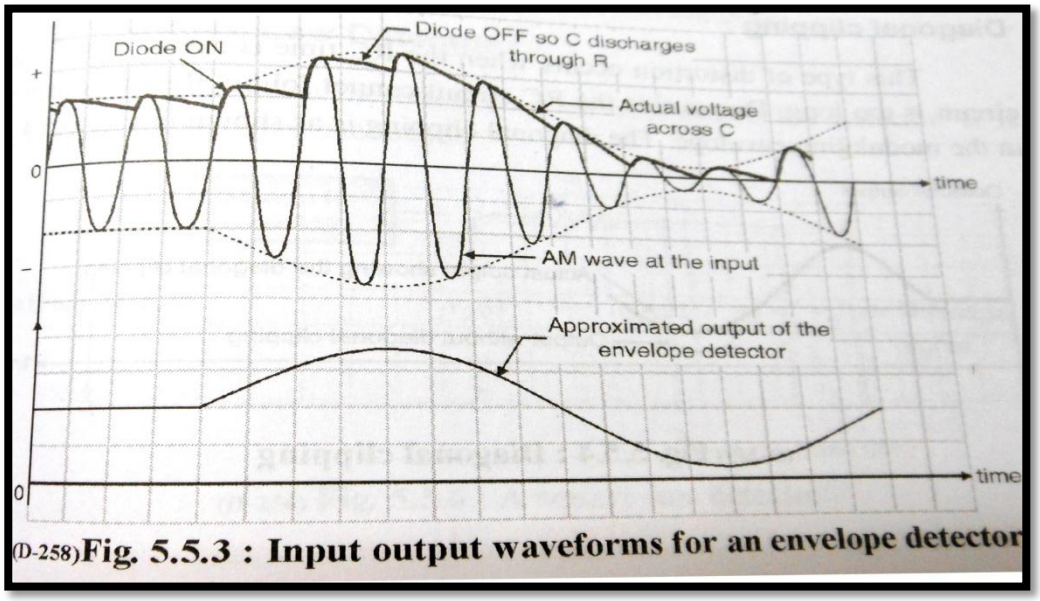



(D-257) **Fig. 5.5.2 : Envelope detector for detection of AM wave**

**Explanation :** **1M**

- The diode is the most common device used for AM demodulation.
- AM signal is applied to input of simple diode detector.
- In every positive half cycle diode is forward biased so that capacitor charges to peak value of input voltage.
- As soon as input voltage goes below peak point voltage, diode will reverse biased and capacitor discharges through R.
- Charging and discharging of capacitor repeats for each cycle that result as positive envelope of AM as shown at output in figure.
- This envelope is nothing but original modulating signal.

**Waveform :** **1M**



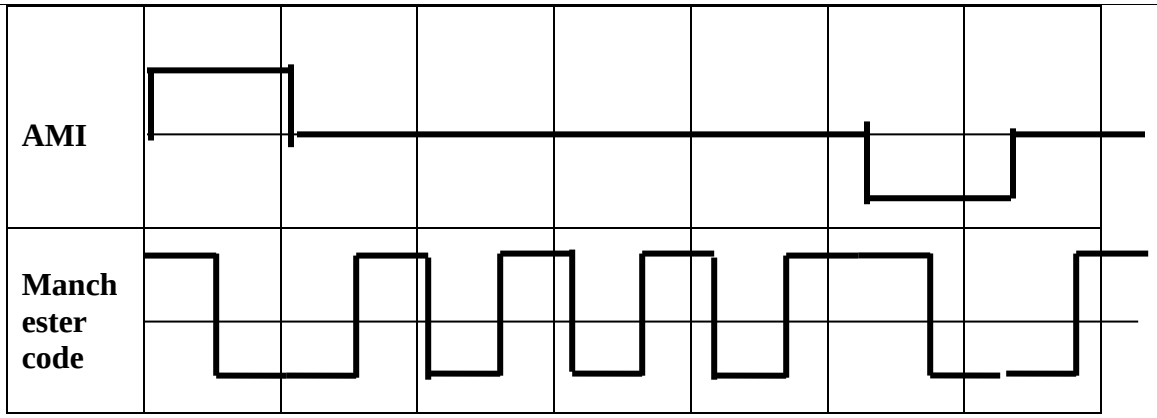

(D-258) **Fig. 5.5.3 : Input output waveforms for an envelope detector**

**c)** **Encode the binary data stream 1000010 into Return to zero, non –return to zero (NRZ), AMI and Manchester code.** **4M**

**Ans:** **Return to zero and non return to zero-** **1 M each**

***Note-Any polar or unipolar to be considered***

| | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| **Return to zero (polar)** | | | | | | | |
| **Return to zero (uni polar)** | | | | | | | |
| **Non return to zero (polar)** | | | | | | | |
| **Non return to zero (uni polar)** | | | | | | | |

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| | **d)** | **Give classification of satellite on the basis of their location and application.** | **4M** |
| | **Ans:** | Satellites are generally classified as, having either a<br>• **Low earth orbit (LEO) :**<br>motorolas satellite based mobile telephone system, iridium is a LEO system utilizing a 66-satellite constellation orbiting approximately 480 miles above the earths surface.<br>• **Medium earth orbit (MEO)** :<br>operates in 1.2 Ghz to 1.66 Ghz frequency band and orbit between 6000 miles and 12000 miles above earth. The department of Defense satellite based global positioning system, NAVSTAR is MEO system with a constellation of 21 working satellite and 6 spares orbiting approximately 9500 miles above earth.<br>• **Geosynchronous earth orbit (GEO)** :<br>these are high altitude earth orbit satellites operating primarily in the 2 Ghz to 18 Ghz frequency spectrum which orbits 22,300 miles above the earths surface. Most commercial communications satellites are in geosynchronous orbit.<br>• **Near synchronous orbit :**<br>satellites in high elevation, non synchronous circular orbit between 19,000 miles and 25,000 miles above earth are said to be in near synchronous orbit. | **4M** |
| | **e)** | **Describe the mobile to mobile call procedure.** | **4M** |
| | **Ans:** | **Explanation :**<br>• Then subscriber dials the number by using touch tone keypad.<br>• The called number as well as the mobile units identification no is given to base station.<br>• If the mobile units id no is valid, the cell site controller routes the called no over a wire line trunk circuit to the MTSO<br>• The MTSO sends a page command to all cell site controller to locate the destination party<br>• Once the destination mobile unit is located the destination cell site controller | **4M** |

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| | | sends a page request through a control channel to the destination party to determine if the unit is ON or OFF.<br>• After receiving a positive response to the page channels are assigned to both mobile units.<br>• Call progress tone is applied in both directions.<br>• When the system receives notice that the called party has answered the telephone, the switches terminate the call progress tones and conversation begins.<br>• If the called party is OFF hook the calling party receives busy signal.<br>• If the called no is invalid, the calling party receives a recorded message announcing that the call cannot be processed. | |
| | **f)** | **Describe the following term related to noise:**<br>**i) Signal to Noise Ratio (SNR)**<br>**ii) Noise figure.** | **4M** |
| | **Ans:** | **<u>Signal to Noise Ratio</u> (SNR)**<br>It is defined as the ratio of signal power to the noise power, often expressed in decibels.<br><br>**<u>Noise figure:</u>**<br>Noise figure is defined as the ratio of the signal to noise power supplied to input terminals of the receiver to the signal to noise power supplied to the output or load resistor.<br>F(Noise Figure) = $\frac{\text{input SNR}}{\text{output SNR}}$<br>Noise figure will be 1 for ideal receiver.<br>Noise figure may be expressed as an actual ratio or in decibels. | **2M**<br><br>**2M** |
| **Q. 3** | | **Attempt any four:** | **16M** |
| | **a)** | **What are the advantages of pulse modulation over continuous wave modulation?** | **4M** |
| | **Ans:** | **<u>Advantages-</u>**<br>• Digital modulation is possible.<br>• PCM is coded form hence it is used for security purpose like military application.<br>• Noise immunity is more.<br>• Good performance of all pulse modulation<br>• Less signal power and cover large communication area.<br>• Transmit modulated signal with low loss.<br>• Avoid interference with other communication.<br>• Make receiving antenna's quite small.<br>• Multiplex signals<br>• Increase channel allocations<br>.• Have better noise immunity | **[Any 4 point 4 M- each point 1 M]** |
| | **b)** | **Draw the block diagram ofPCM. Write its working principle.** | **4M** |
| | **Ans:** | | |

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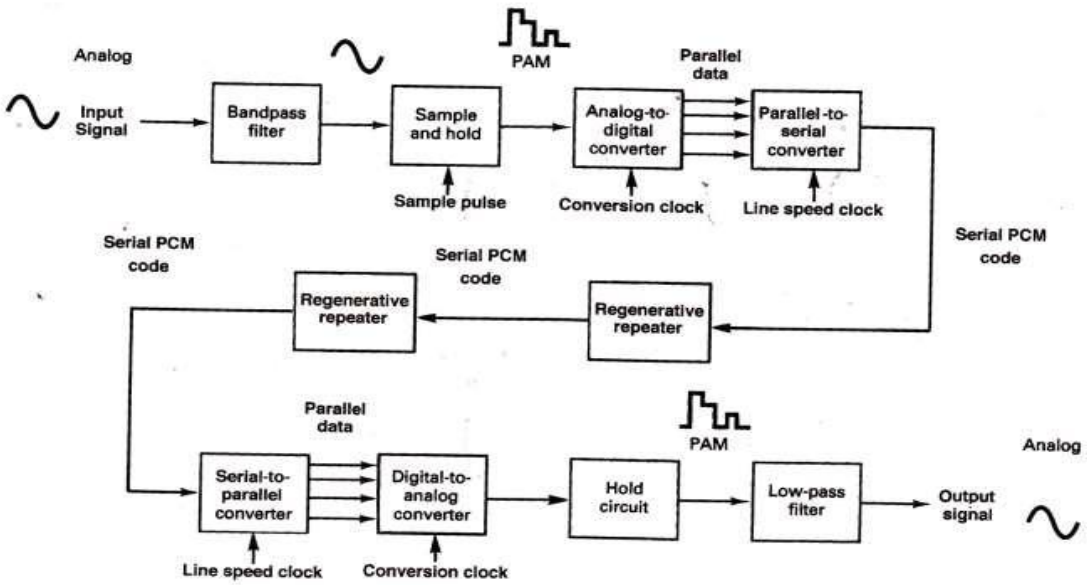
| | | **Diagram:**<br>  <br><br>**Working principle of PCM**:- The analog signal x (t) is passed through a band limiting low pass filter, which has a cut-off frequency fc =W Hz. This will ensure that x (t) will not have any frequency component higher than "W". This will eliminate the possibility of aliasing. The band limited analog signal is then applied to a sample and hold the circuit where it is sampled at adequately high sampling rate. Output of sample and hold block is a flat topped PAM signal. These samples are then subjected to the operation called "Quantization" in the "Quantizer". The quantization is used to reduce the effect of noise. The combined effect of sampling and quantization produces the quantized PAM at the quantizer output. The quantized PAM pulses are applied to an encoder which is basically an A to D converter. Each quantized level is converted into an N bit digital word by the A to D converter. The value of N can be 8,16,32,64 etc. The encoder output is converted into a stream of pulses by the parallel to serial converter block. Thus at the PCM transmitter output we get a train of digital pulses. | **2M**<br><br>**2M** |
| **c)** | **State any four specification of LASER and LED each.** | | **4M** |
| **Ans:** | Laser diode wave length -650 nm,<br>Size package- 2mm,<br>Distance travel -100m,<br>Speed of operation -10 gb/s<br>Power require -3w,<br>***[ Note:Specification value will as per application type mark can given for logical ans]***<br>**LED-**<br>Wave length depend on colour for red led it is from 550nm to 950nm<br>Size 3mm to 5mm<br>Distance 1m<br>Power ½ W | | **(2M for laser, 2M for LED Any four point)** |

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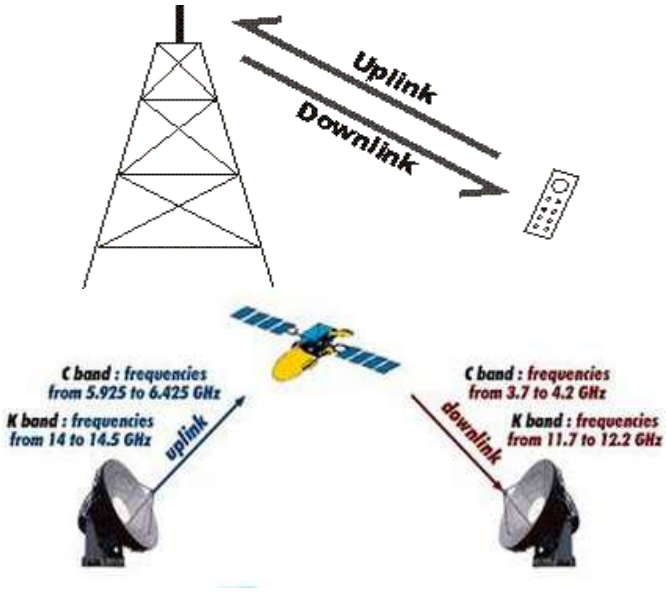
| | Short distance<br>***[Note:Any other specification can consider]*** | |
| **d)** | **Describe working principle of uplink and downlink model of satellite communication with block diagram.** | **4M** |
| **Ans:** | **Downlink Frequency**: In satellite telecommunication, a downlink is the link from a satellite down to one or more ground stations or receivers.<br><br>**Uplink Frequency**: An uplink is the link from a ground station up to a satellite<br><br>  <br><br>**Uplink frequency is not same as down link frequency. Uplink frequency higher than down link frequency, and transponder is design for same**<br>• It's all about power considerations. In satellite communication, the signals have to cross the atmosphere which presents a great deal of attenuation. The higher the frequency, the more is the signal loss and more power is needed for reliable transmission.<br>• Lower frequencies get reflected by atmospheric bands and cannot penetrate to get through to the satellite.<br>• As satellite is a light-weight device which cannot support high-power transmitters on it. So, it transmits at a lower frequency (higher the frequency, higher is the transmitter power to accommodate losses) as compared to the stationary earth station which can afford to use very high-power transmitters. This is compensated by using highly sensitive receiver circuits on the earth station which is in the line-of-sight (LOS) of the satellite | **Diagram-2M, Explanation -2M** |
| **e)** | **Describe the following interferences occurred in celluar communication system with the help of neat schematic diagram.** | **4M** |
| **Ans:** | The concept of cellular system in mobile communication is that rather than servicing a given geographical area with a single transmitter & receiver, the system divides the service area into many smaller areas known as cells. The receiver in each cell station continuously monitors the signal strength of the mobile unit. | **Diagram-2M, Explanation -2M** |

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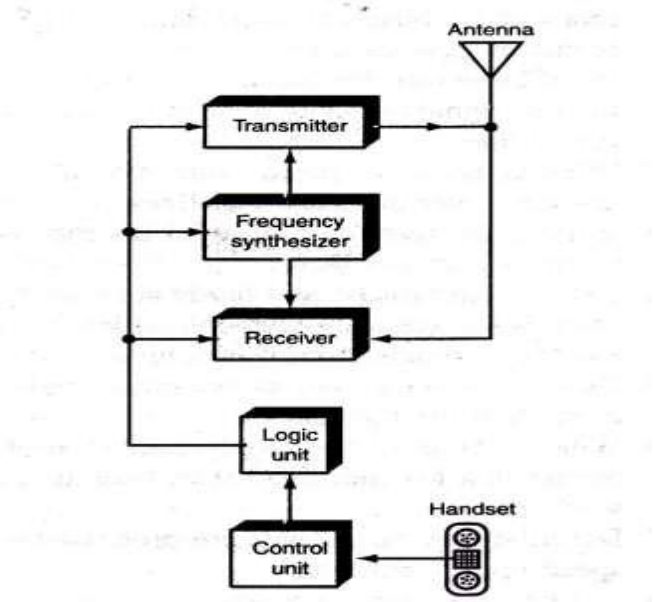
| | |  <br>• When the signal strength deeps below a desired level, it automatically seeks a cell where the signal from the mobile unit is stronger.<br>• Mobile unit consists of five major sections transmitter, receiver, synthesizer, logic unit, & control unit.<br>• It contain a built in rechargeable batteries.<br>• The transmitter & receiver share a single antenna. | |
| | **f)** | **Describe the following interfferences occurred in celluar telephone network:**<br>**i) Co-channel interference**<br>**ii) Adjacent channel interference** | **4M** |
| | **Ans:** | **Co-channel Interference** is a crosstalk from two different radio transmitters using the same frequency. Or interference in nearby channels having same frequency Co-channel interference can be avoided by using 1. Proper frequency planning. 2. Increasing distance between two co-channels<br>**Adjacent channel interference**: Interference resulting from signals which are close in frequency to the desired signal is called adjacent channel interference. The adjacent channel interference can be reduced by 1) Careful filtering 2) Careful channel assignment. | **(2M for co channel 2M for adjacent channel)** |
| **Q. 4** | **A)** | **Attempt any four :** | **16M** |
| | **a)** | **Define modulation index of AM. Calculate modulation index of AM signal with V max = 20 mV and $V_{min}$ =10mV.** | **4M** |
| | **Ans:** | Modulation index in AM : it is the ratio of amplitude of modulating signal to the amplitude of the carrier signal.<br>**Formula-**<br>M=(Vmax- Vmin)/(Vmax+Vmin)<br>M=20-10/ 20+10= .333<br>% modulation=100x.333= 33.33 | **(1M for definition, 1M for formula, 2M for calculation)** |
| | **b)** | **Draw blockdiagram delta modulation and state function of each block.** | **4M** |
| | **Ans:** | | |

| | | | |
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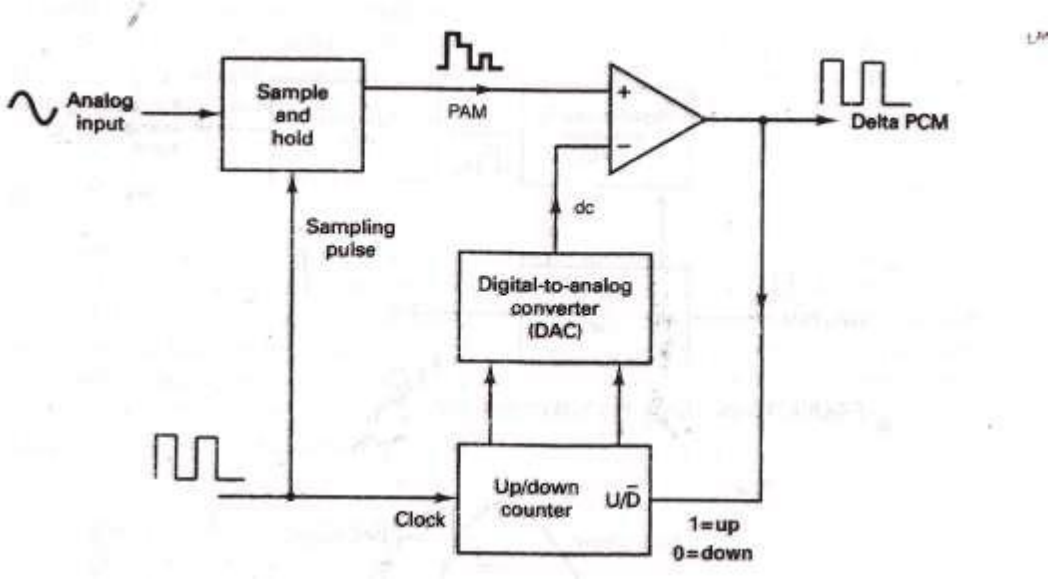
| | | **Diagram:**<br>  <br><br>**Working:**<br>1. Sample and Hold circuit: The input analog is sampled and converted to a PAM signal.<br>2. DAC: The output of DAC is a voltage equal to the regenerated magnitude of the previous sample , which was stored in the up-down counter as a binary number.<br>3. Up-Down counter: The up-down counter is incremented or decremented depending on whether the previous sample is larger smaller than the current sample. The up-down counter is clocked at a rate to the sample rate. Therefore up-down counter is updated after each comparison. | **2M**<br><br>**2M** |
| **c)** | | **State different frequency bands used in satellite communication.** | **4M** |
| **Ans:** | | **Frequency bands used in satellite communication.**<br>Band Frequency<br>L 1.53 – 2.7 GHz<br>S 2.5 – 2.7 GHz<br>C 3.4 – 6.4 GHz<br>X 7.2 – 8.4 GHz<br>Ku 10.95 – 14.5 GHz<br>Ka 17.7 – 31 GHz<br>Q 36 – 46 GHz<br>V 46 – 56 GHz<br>W 56 – 100 GHz | **(Any 4 bands- 4M)** |
| **d)** | | **State advantages of multimode graded index fiber, single mode step index fiber.** | **4M** |
| **Ans:** | | **Advantages of multimode graded index fiber-**<br>1)Allow the use of non- coherent optical light source ie LED<br>2)Impose lower Tolerance requirement on fibre connector<br>3)Reduced dispersion compared with step index multimode fibre<br>4) Considerable decrease in modal dispersion.<br><br>**Advantage of single mode step index fiber-** | **(2M for multimode, 2M for single mode)** |

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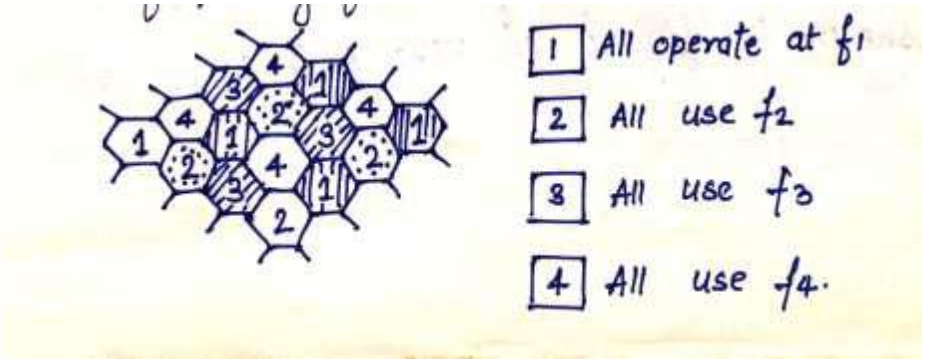
| | | 1) Only one mode is allowed due to diffraction / interference effect<br>2) Allow use of high power laser<br>3) Low disepersion high bandwidth<br>4) Low loss | |
| | **e)** | **Write electrical characteristics ofRS-232 standard.** | **4M** |
| | **Ans:** | | **4M** |

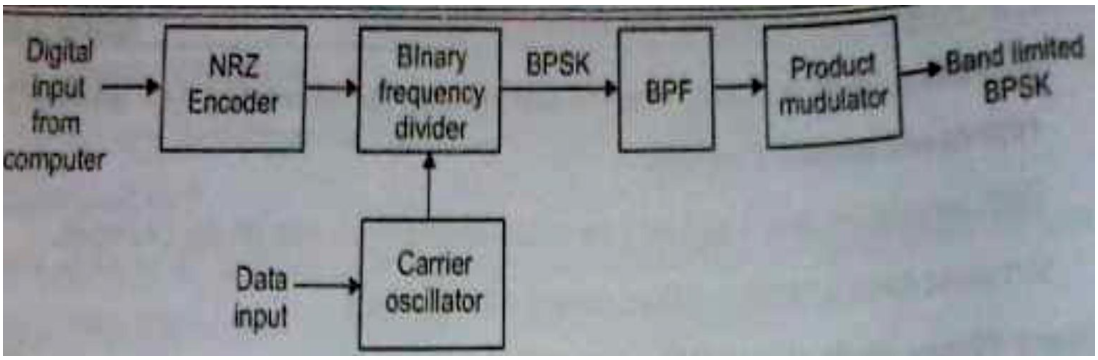
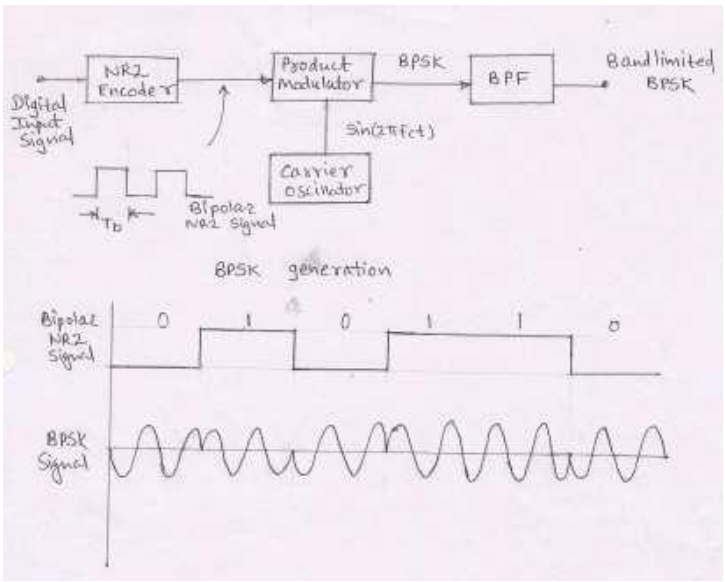
| | Data Signals | | Control Signals | |
|---|---|---|---|---|
| | Logic 1 | Logic 0 | Enable (On) | Disable (Off) |
| Driver (output) | −5 V to −15 V | +5 V to +15 V | +5 V to +15 V | −5 V to −15 V |
| Terminator (input) | −3 V to −25 V | +3 V to +25 V | +3 V to +25 V | −3 V to −25 V |

| | | | |
|---|---|---|---|
| | **f)** | **With the help of suitable diagram describe the concept of cellular frequency reuse. State mathematical formula which gives the total number of cellular channels, those are available in the cluster.** | **4M** |
| | **Ans:** | **Diagram:** | **1M** |




**Explanation:** **2M**

- Frequency reuse refers to the use of radio channels operating on the same frequency, to cover different areas that are physically separate from each other.
- In the frequency reuse it is necessary to see that co-channel interference is not objectionable.
- In frequency reuse concept, a single transmitter of higher power need not to be used to cover entire area.
- Instead many transmitters of small output power operating at the same frequency can be used.
- This technique also reduces the minimum height of transmitting antenna, because each antenna has to cover small area.
- The users located in different geographical area i.e. different cells can use same frequencies.
- The advantage of frequency reuse is that it drastically increases the spectrum efficiency but if the system is not designed properly then co-channel interference may take place.
- Frequency reuse technique popularly use in cellular phone system as shown in the

| | | | |
|---|---|---|---|
| | | above diagram.<br>• It uses the same frequency repeatedly in the same area in one system.<br>• Here the total frequency spectrum allocation is divided into four co-channel cells in the system.<br>• The cells marked -1 will use same frequency say $f_1$, the cells marked 2 will use same frequency $f_2$ and so on.<br><br>Formula cluster size $C=i^2+ixj+j^2$ [where integer i and j are relative location of co channel for example i= 1 and j =2 then c=7] | **1M** |
| **Q.5** | | **Attempt any four :** | **16M** |
| | **a)** | **Draw block diagram of BPSK generation. State functions of each block .** | **4M** |
| | **Ans:** | **Diagram :**<br>  <br><br>**OR**<br>  <br> | **2M** |

**Working:**

- **NRZ Encoder:**

This converts binary data signal (0's and 1's) into NRZ bipolar system**.**

- **Carrier Oscillator:**

Generates sine wave carrier signal.

- **Product Modulator:**

Multiplies input data and carrier which results BPSK signals.

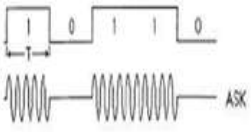
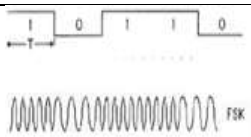
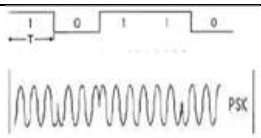
- **BPF:**

IT is band pass signal which limits the frequency band of BPSK.

**2M**

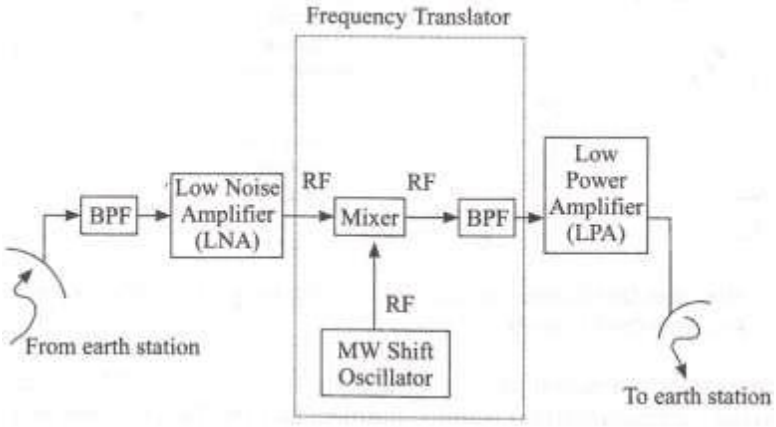
**b)** **Compare ASK, FSK, PSKon the basis of waveform, variable parameters, noise immunity and bandwidth requirement** **4M**

**Ans:** **Each point-1M**

| **Parameters** | **ASK** | **FSK** | **PSK** |
|---|---|---|---|
| **variable parameters** | AMPLITUDE | . FREQUENCY | PHASE |
| **waveform,** |  |  |  |
| **bandwidth** | (1+r)R<br>R= bit rate,r=1 | 4fb<br>fb=bit frequency | fb |
| **noise immunity** | LESS | MORE | MORE |

**c)** **Describe the working of transponder used in satellite communication.** **4M**

**Ans:** **Diagram :** **2M**




**Working :** **2M**

- It consists of receiving antenna (f = uplink frequency), a band limiting circuit band pass filter, an input low
- noise amplifier, frequency translator, output low power amplifier, and transmitting antenna (f = downlink frequency).
- The frequency translator is basically an RF to RF repeater. The frequency of MW

| | | | |
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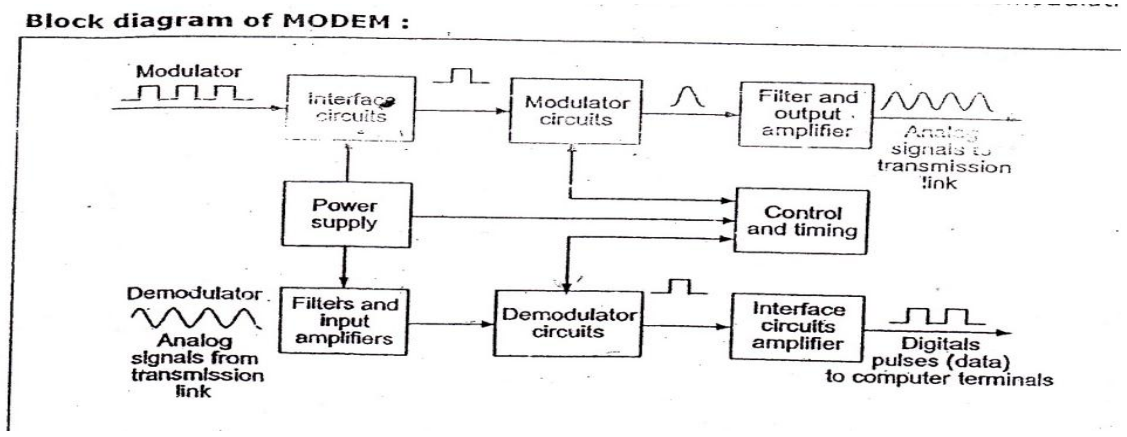
| | | shift oscillator is equal to<br>• Frequency shift required and hence it is equal to difference of uplink and downlink frequency (usually = 2GHz.) | |
| | **d)** | **State functions of hubs, repeaters, routers and bridges.** | **4M** |
| | **Ans:** | **Hub**:<br>A common connection point for devices in a network. Hubs are commonly used to connect segments of a<br>LAN. A hub contains multiple ports. When a packet arrives at b1 port, it is copied to the other ports so that all<br>segments of the LAN can see all the packets.<br><br>**Repeaters**:<br>A repeater is the simplest facility used for network interconnection, whose major function is to<br>receive a network signal from one LAN terminal cable segment and to regenerate and retransmit the signal as it<br>is in its original strength over a one or more other cable segment. Basically repeater regenerates the strength of<br>the signal before transmitting it.<br><br>**Routers**:<br>A device that connects any number of LANs. Routers use headers and a forwarding table to determine<br>where pkts go and they use ICMP to communicate with each other and configure the best route between any 2 hosts<br><br>**Bridge:**<br>A device that connects two local-area networks (LANs), or two segments of the same LAN. The two LANs being connected can be alike or dissimilar. For example, a bridge can connect an Ethernet with a Token-Ring network. Unlike routers, bridges are protocol -independent. They simply forward packets without analyzing and re-routing messages. Consequently, they're faster than routers, but also less versatile | **1M**<br><br>**1M**<br><br>**1M**<br><br>**1M** |
| | **e)** | **Draw the block of MODEM. Describe the function of each block.** | **4M** |
| | **Ans:** | **Circuit Diagram-**<br>  <br><br>**Definition:** MODEM is an acronym for MODulator DEModulator.A modem is a device that converts data from digital computer signals to analog signals that can be sent over a | **2M** |

| | | | |
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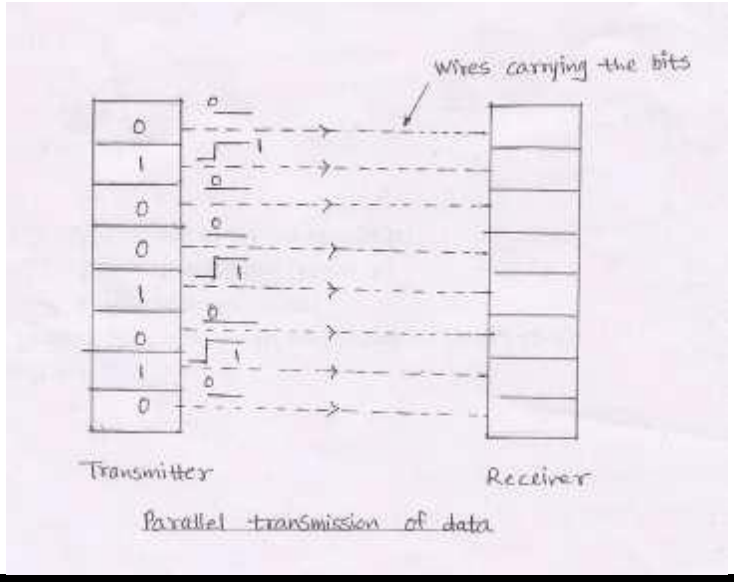
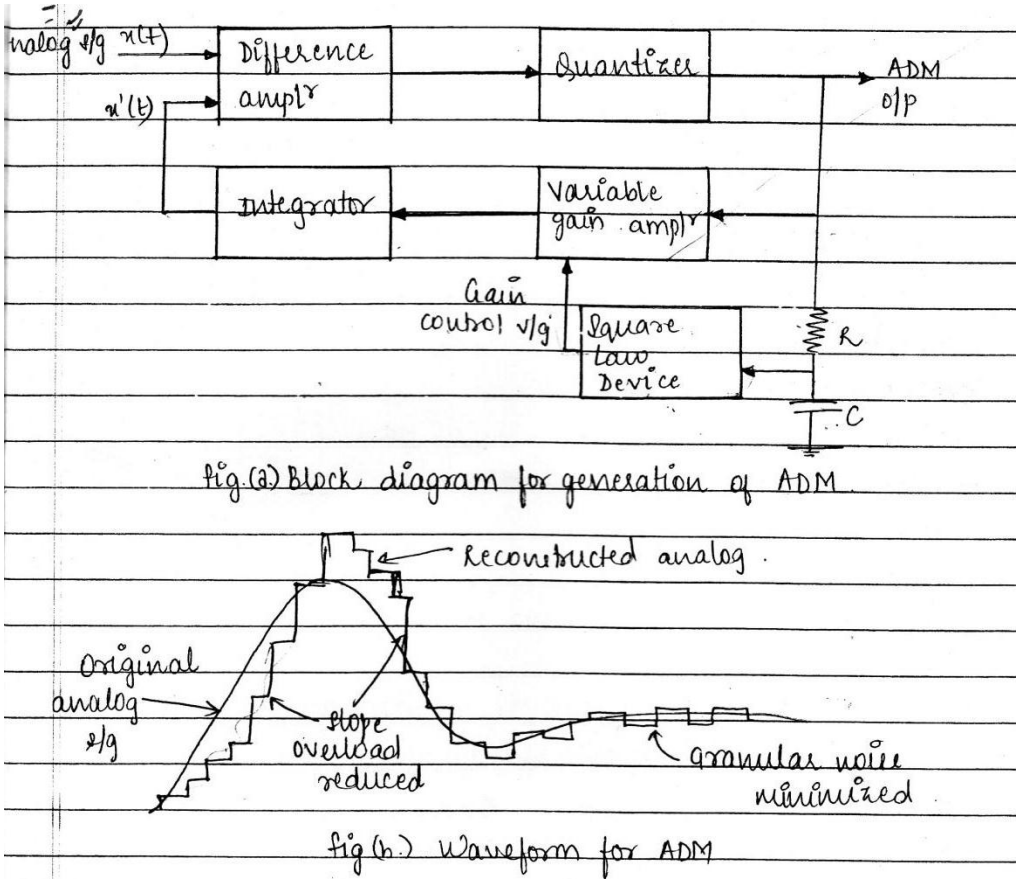
| | | phone line.This is called modulation.The analog signals are then converted back into digital data by the receiving modem.This is called demodulation.<br>**Function of each block:**<br>**Interfacing circuit:** To transmit byte data, it is necessary to convert byte into eight signal bits.This parellel to serial conversion is done by interfacing circuits.UART 8250 can be used to serve this purpose.<br>**Modulator Circuit:**Serial data (in digital room) coming from interfacing circuit is converted into analog signal with two frequencies:1070 Hz for logic '0' and 1270 Hz for logic "1"<br>**Filter and Amplifier:** The two frequencies are sent with amplified form through telephone line.<br>**Control and Timing Circuit:** To estabish the communication link between transmitting and receiving modem,control circuit is used.<br>Demodulator converts signal back to original form to feed it to computer terminal. | **2M** |
| | **f)** | **Describe parallel data transmission mode.** | **4M** |
| | **Ans:** | **Explanation :**<br>• In parallel transmission of data, all the bits of a byte are transmitted simultaneously on separate wires.<br>• This type of transmission requires multiple circuits for interconnecting two devices.<br>• Parallel transmission is possible practically if the two devices are close to each other.<br>• The advantage of parallel transmission is that all the data bits will be transmitted simultaneously. Therefore the time required for the transmission of N-bit word is only one clock cycle. Due to this the clock frequency can be kept low without affecting the speed of operation.<br>• It has one disadvantage that , to transmit an N bit word, we need N number of wires. With increase in the number of users, these wires will be two many to handle.<br><br>**Diagram :**<br>  <br><br>Parallel transmission of data | **2M**<br><br>**2M** |
| **Q.6** | | **Attempt any four :** | **16M** |

| | | | |
|---|---|---|---|
| | **a)** | **Which errors are occurred in delta modulation? How to overcome these errors? Which circuit is used for this purpose?Draw and explain that circuit in detail.** | **4M** |
| | **Ans:** | **Errors occurred in delta modulation-**<br>1. Slope Overload<br>2. Granlar Noise<br>These both error is overcome to use adptive delta modulator, in which step size adptive to the information signal.<br>  <br><br>fig.(a) Block diagram for generation of ADM.<br><br><br>fig (b) Waveform for ADM<br>**Adaptive Delta Modulation (Adm):**<br>• ADAPTIVE DELTA MODULATION is a delta modulation system, where the step size of the DAC automatically varied , depending on the amplitude characteristics of the analog input signal<br>• The block diagram for ADM signal generation is shown in fig<br>• The step size $\partial$ is varied by controlling the gain of the integrator which is assume to have a low gain when control voltage is zero and large gain when control voltage increases<br>• When the input signal is constant or slowly varying, DM will be hunting and output will be sequence of alternate polarity pulses<br>• This pulses when integrated by RC filter, yield an average output of almost zero<br>• The gain control input and hence the gain and step size are small as shown in the waveform<br>• When the input signal varies very fast (slope overload), the output of quantizer will be train of all positive or negative pulses the integrator now provides a large control voltage and the gain of the amplifier will be increases. Because of square | **2M**<br><br>**2M** |

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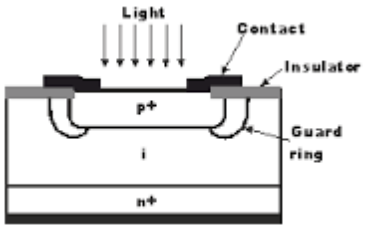
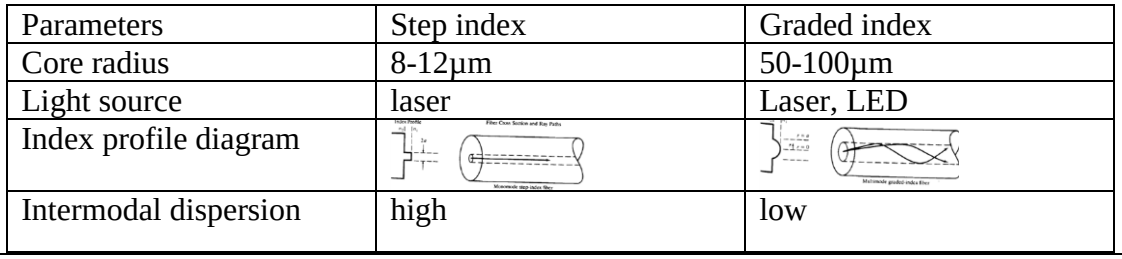
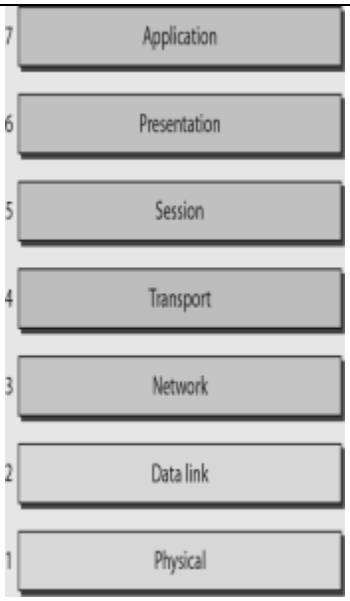
| | | law device, gain will be increased no matter what the polarity of the pulses are. The net result is an increase in step size and reduction in slope overload | |
| | **b)** | **Describe the working principle of avalanche photodiode with the help of suitable diagram.** | **4M** |
| | **Ans:** | **Diagram :**<br>  <br><br>**Working :**<br>The avalanche process means that a single electron produced by light in the un-doped region is multiplied several times by the avalanche process. As a result the avalanche photo diode is far more sensitive.<br>Light enters the un-doped region of the avalanche photodiode and causes the generation of hole-electron pairs.<br>Under the action of the electric field the electrons migrate towards the avalanche region. Here the electric field causes their velocity to increase to the extent that collisions with the crystal lattice create further hole electron pairs.<br>In turn these electrons may collide with the crystal lattice to create even more hole electron pairs.<br>In this way a single electron created by light in the un-doped region may result in many more being created. | **2M**<br><br>**2M** |
| | **c)** | **Compare step index with graded index fiber on the basis of :**<br>**i) Core radius**<br>**ii) Light source**<br>**iii) Index profile diagram**<br>**iv) Intermodal dispersion.** | **4M** |
| | **Ans:** |  <br> | **Each Point-1M** |
| | **d)** | **List the layers of OSI model and state function of any three layer.** | **4M** |
| | **Ans:** | **Diagram :** | **2M** |




**2M**
**(Any Three)**

**Explanation:**

**Physical Layer** : To transmit bits over medium. To provide electrical and mechanical Specifications.

**Data Link Layer**: To organize bits to frame .To provide hop to hop delivery.

**Network Layer**: To move packets from source to destination .To provide internetworking.

**Transport Layer**: To provide reliable process to process message delivery and error recovery

**Session Layer**: To establish manage and terminate session.

**Presentation Layer**: To translate encrypt and compress data

**Application Layer** :To allow access to network resources

| | | |
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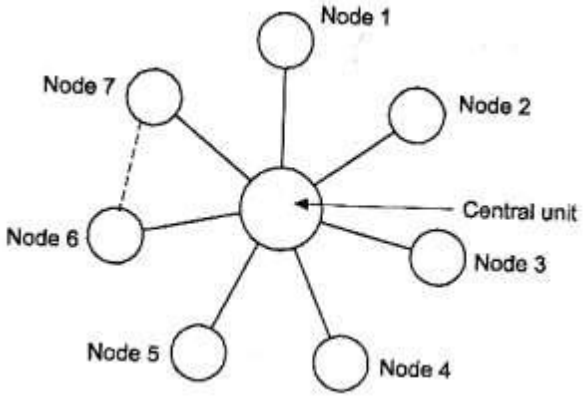
| **e)** | **Draw and describe star LAN configuration.** | **4M** |
| **Ans:** | LAN (Local Area Network) is a computer network covering a small geographic area, like a home, office, school, or group of buildings. | |
| | **Diagram :** | **2M** |




A large no. of users can be connected to the central node

- Each user on a star network communicates with a central hub that resends the message either to all the computers of a star network or only to the destination computer in a switched star network.

**2M**

<table>
<tr><td></td><td></td><td>• The central node acts as a switch to direct the data from transmitter to the receiver.<br>• New number or nodes can be easily added without breaking path.</td><td></td></tr>
<tr><td></td><td>f)</td><td>Differentiate between FDMA,TDMA,CDMA on the basis of following parameters:<br>i) Multiplexing technique<br>ii) Power efficiency<br>iii) Synchronization<br>iv) Guard band.</td><td>4M</td></tr>
<tr><td></td><td>Ans:</td><td><table>
<tr><td>Parameter</td><td>FDMA</td><td>TDMA,</td><td>CDMA</td></tr>
<tr><td>Multiplexing Tech.</td><td>frequency</td><td>time</td><td>Code division</td></tr>
<tr><td>Power efficiency</td><td>less</td><td>full</td><td>full</td></tr>
<tr><td>Synchronization</td><td>Not require</td><td>require</td><td>require</td></tr>
<tr><td>Guard band</td><td>Guard band require</td><td>Guard time require</td><td>Both band require</td></tr>
</table></td><td>Each Point-1M</td></tr>
</table>