ESE | GATE | PSUs

ELECTRONICS & TELECOMMUNICATION ENGINEERING

ADVANCED COMMUNICATION

Study Material with Classroom Practice Questions

Chapter 1 Communication Networks
(Solutions for Vol-1_Classroom Practice Questions)

01. Ans: (b)
Sol: Data Link Layer is responsible for the decoding bit stream into **frames**.

02. Ans: (a)

03. Ans: (c)
Sol: Frame encapsulates packet

04. Ans: (d)
Sol: The End-to-End delivery of the entire message is the responsibility of the Transport layer.

05. Ans: (b)
Sol: As the data packets moves from the upper to lower layers, headers are added.

06. Ans: (a)
Sol: **Data link layer:** Ensures reliable transport of data over a Physical point-to-point link

Network layer: Routes data from one network node to the next

Transport layer: Allows end - to - end communication between two processes

07. Ans: (b)
Sol: Ethernet implements Connectionless service for its operation

08. Ans: (d)
Sol: TCP/IP model does not have session layer and presentation layer but OSI model have these layer.

09. Ans: (b)
Sol: ISO OSI reference model has 7 layers.

10. Ans: (a)
Sol: The physical layer concerns with Bit - by - bit delivery

11. Ans: (a)
Sol: The data link layer takes the packets from Network layer and encapsulates them into frames for transmission

12. Ans: (b)
Sol: The network layer protocol of internet is Internet protocol

13. Ans: (a)
Sol: User datagram protocol is called connectionless because all UDP packets are treated independently by transport layer

14. Ans: (a)
Sol: SMTP protocol deals with emails in application layer.

15. Ans: (a)
Sol: Ethernet frame consists of MAC address

16. Ans: (a)
Sol: In Star topology there is a central controller or hub.

17. Ans: (b)
Sol: WAN is a Data communication system spanning states, countries, or the whole world.

Chapter 2 Switching
(Solutions for Vol-1_Classroom Practice Questions)

01. Ans: (c)

Sol: Frame relay technique uses connection oriented packet switching.

02. Ans: (a)

Sol: Given data

Circuit setup time = 's' sec

Bandwidth = bit rate = 'b' bps

Path = 'k'-hop

Propagation delay = 'd' sec per hop

Connection release = not given

Packet size = 'p' bits

Message size = 'x' bits

k = 3

k – hop path (hop means jump)

$T_P = \frac{d}{v} = \frac{m}{m/s} = \text{sec}$

Total delay = I + II + III

I. Circuit setup time = s

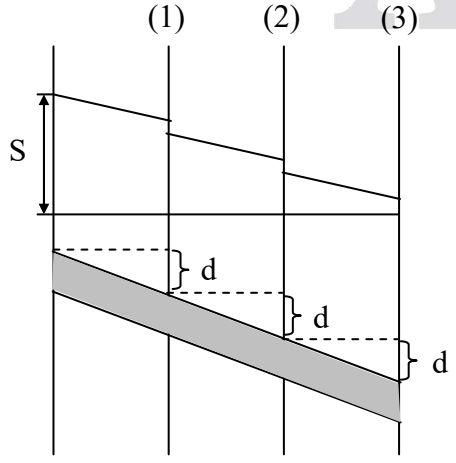
II. $T_X = \frac{L}{B} = \frac{\text{message size}}{\text{bit rate}} = \frac{x}{b}$

III. T_P=one hop → propagation time='d' sec

For k hop → propagation time ?

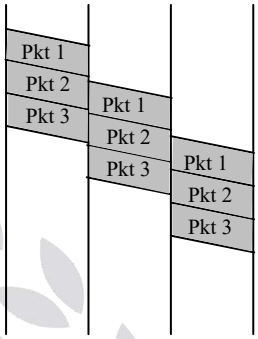
$= k \times d$

∴ Total delay = s + x/b + k.d



03. Ans: (d)

Sol:



- The last packet is getting retransmitted at k – 1 hops so the delay is $(k-1)\frac{p}{b}$.
- There is no set of time (NO S)
- Transmission delay is x/b

$= \frac{p_1 + p_2 + .. + p_n}{b}$

- Message

  For k hop → propagation time?

  $= k \times d$

- Total time = $x/b + k.d + (k-1)\frac{p}{b}$

04. Ans: (a)

Sol: A packet can be forwarded before the next packet arrives in virtual circuit connections, so in between the packets the delay jitter is zero.

05. Ans: (c)

Sol: Packet switching is the method by which the internet works, it features delivery of packets of data between devices over a shared network. For example the school web server sending a webpage over the internet or sending an email to a friend. To get from one device to another the data packets will have to travel through network adapters, switches, routers and other network nodes. The route taken by each packet might vary and at times there might be a lot of data travelling through these nodes meaning packets will be queued. This results in varying times it takes to send data from one device to another depending on the traffic load in the network.

Packet switching is a method of grouping data transmitted over a digital network into packets which are composed of a header and a payload. Data in the header is used by networking hardware to direct the packet to its destination where the payload is extracted and used by application software. Packet switching is the primary basis for data communications in computer networks worldwide.

Chapter 3 Protocols (TCP/IP)

(Solutions for Vol-1_Classroom Practice Questions)

01. Ans: (b)

Sol: **TCP Services:** SMTP, HTTP, FTP

02. Ans: (b)

Sol: Host-to-Host layer in the TCP/IP stack is equivalent to the Transport layer of the OSI model.

03. Ans: (d)

04. Ans: (b)

Sol: SMTP protocol deals with emails

05. Ans: (a)

Sol: TCP protocol ensures reliable delivery.

06. Ans: (d)

Sol: TCP/IP model does not have session layer & presentation layer but OSI model have these layers.

07. Ans: (c)

Sol: An IPv4 address consists of 32-bits

08. Ans: (a)

09. Ans: (d)

10. Ans: (b)

11. Ans: (d)

12. Ans: (b)

Sol:

0001 0111. 0010 1010. 1000 0100. 1100 1000

1 7 2 A 8 4 C 8

1 7 2 A 8 4 C 8

1×16^1 2×16^1 8×16^1 12×16^1

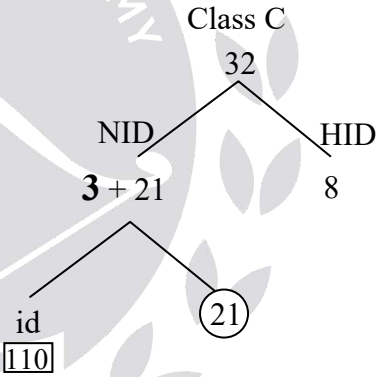
$+7\times16^0$ $+10\times16^0$ $+4\times16^0$ $+8\times16^0$

$= 23$ $= 42$ $= 132$ $= 200$

$\therefore$ 23.42.132.200

13. Ans: (c)

Sol:

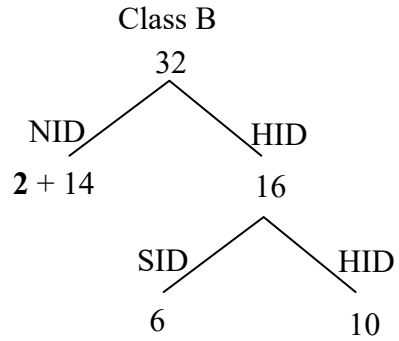


$= 2^{21}$

From NID, 3 bits are reserved for prefix of class C address therefore number of networks all allowed under class C address are $2^{24-3} = 2^{21}$.

14. Ans: (d)

Sol:



64 departments = 2^6

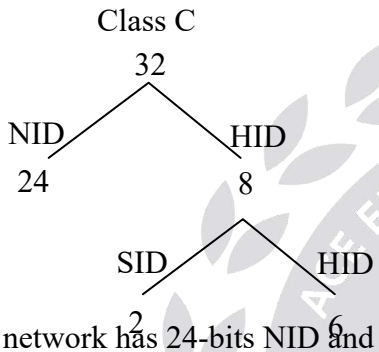
1111 1111. 1111 1111. 1111 1100. 0000 0000

255. 255. 252. 0

15. (i) Ans: (a) (i) Ans: (b)
(iii) Ans: (b)

Sol: SM = 255.255.255.192

192 = 1100 0000



Class C network has 24-bits NID and 8 bit HID

(i) 2 bits are borrowed from HID

(ii) no. of subnets = $2^2 = 4$

(iii) no. of system per subnet = $2^6 - 2$

$= 64 - 2 = 62$

16. Ans: (d)

Sol: → TCP enable two hosts to establish a connection and exchange streams of data.

→ TCP guarantees delivery of data in the same order in which they are sent.

→ TCP segmentation offload is used to reduce the CPU overhead of TCP/IP on fast networks.

17. Ans: (a)

Sol: NAT is short for Network Address Translation. NAT is an Internet standard that enables a local area network (LAN) to use one set of IP addresses for internal traffic and a second set of addresses for external traffic. A NAT box located where the LAN meets the Internet makes all necessary IP address translations.

The Purpose of NAT

NAT serves for three main purposes:

- Provides a type of firewall by hiding internal IP addresses
- Enables a company to use more internal IP addresses. Since they're used internally only, there's no possibility of conflict with IP addresses used by other companies and organizations.
- Allows a company to combine multiple ISDN connections into a single Internet connection.

18. Ans: (a)

Sol: Connection-Oriented and Connectionless Protocols in TCP/IP. Looking again at TCP/IP, it has two main protocols that operate at the transport layer of the OSI Reference Model. One is the Transmission Control Protocol (TCP), which is connection-oriented; the other, the User Datagram Protocol (UDP), is connectionless.

Connection-oriented protocol service is sometimes called a "reliable" network service, because it guarantees that data will arrive in the proper sequence. Transmission Control Protocol (TCP) is a connection-

oriented protocol. TCP is used for applications that require the establishment of connections (as well as TCP's other service features), such as FTP; it works using a set of rules, as described earlier, by which a logical connection is negotiated prior to sending data.

UDP is used by other applications that don't need connections or other features, but do need the faster performance that UDP can offer by not needing to make such connections before sending data.

Chapter 4 Cellular Network
(Solutions for Vol-1_Classroom Practice Questions)

01. Ans: (d)

Sol: The main part(s) of basic cellular system is
(i) A mobile Unit
(ii) A cell Site
(iii) A mobile Telephone Switching Office

02. Ans: (a)

Sol: The basic GSM is based on connection oriented traffic channels.

Chapter 5 Network Security

(Solutions for Vol-1_Classroom Practice Questions)

01. Ans: (d)

Sol: RSA Algorithm:

Step: (I) p = 3, q = 11

Step: (II) $n = p \times q = 3 \times 11 = 33$

$z = (p-1)(q-1)$

$= (3-1)(11-1)$

$= (2 \times 10)$

$= 20$

$z = 20$

Step: (III) Given e = 3: Public key

Step: (IV) $(d \times e) \bmod z = 1$

$(d \times 3) \bmod 20 = 1$

$21 \bmod 20 = 1$

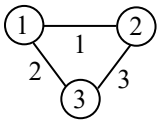
$(d \times 3) = 21$

$d = \frac{21}{3} = 7$

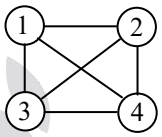
private key = 7

02. Ans: (c)

Sol: 2-nodes

3-nodes 

3 keys $\Rightarrow 1 + 2$

4-nodes 

$1 + 2 + 3 = 6$ keys

N-nodes $\Rightarrow 1+2\ldots. + (N-1) = \frac{N(N-1)}{2}$ keys

Chapter 6 Microwave Communication
(Solutions for Vol-1_Classroom Practice Questions)

01. Ans: (a)

Sol:

- For television broadcasting we are using VHF and UHF frequency bands since we need to transmit both audio and video signals.
- For these frequency bands, we are using space wave (line-of-sight) propagation because at such frequencies sky wave and ground wave propagations both fail.
- At this frequency range, sky wave are fail to reflect from ionosphere (rather they penetrate through it) and ground waves are completely attenuated after few hundred meter propagation because of wave tilt and attenuation by earth surface.
- This mode of propagation is also used in radar and frequency modulations.

02. Ans: (b)

Sol:

- The sky waves (Ionospheric waves) are used at medium and high frequencies for very long distance radio communications.
- Since, in this mode of propagation EM waves reach the receiving point after reflection from the ionosphere which is situated above earth surface as shown in figure.

(a)

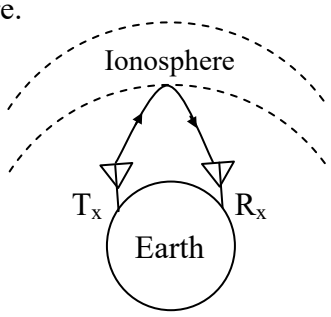


Fig. single reflection of radio waves from ionosphere

(b)

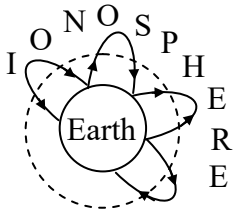


Fig. Multiple reflections of radio wave from ionosphere

- In a single reflection from the ionosphere the radio waves cover a distance not more than 4000km as shown in figure (a).
- Extremely long distance i.e., round the globe communications also possible with the multiple reflections of sky waves as shown in figure (b).

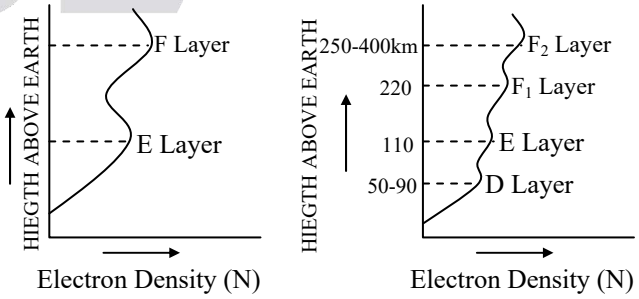
03. Ans: (b)

Sol:

- The relative permittivity of the ionosphere at radio frequency is less than one.

04. Ans: (b)

Sol: The disappearance of few layers in the night is due to recombination of ions into molecules as shown in figure (a) and (b) which shows electron density during night and day.

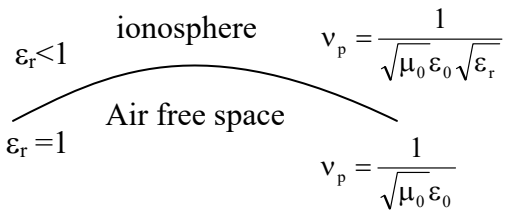


(b) night (a) day

Fig. Electrons density variation during (a)day, (b) night

05. Ans: (b)

Sol:



$$(v_p)_{air} = \frac{1}{\sqrt{\mu_0\varepsilon_0}} \quad \text{——(1)}$$

$$(v_p)_{ionosphere} = \frac{1}{\sqrt{\mu_0\varepsilon_0}\sqrt{\varepsilon_r}} \quad \text{——(2)}$$

From equation (1) and (2),

$(v_p)_{ionosphere} > (v_p)_{air}$ [$\because \varepsilon_r < 1$]

i.e., when a wave travels from air into ionosphere, the velocity of the wave increases.

06. Ans: (c)

Sol:

- Ground wave is propagating around the curvature of the earth and hence it is unaffected whether it is day (or) night.
- Whereas for tropospheric waves and sky waves are effected in different ways in day and night. Since these waves are travelling in earth atmosphere.
- During daytime few extra layers are created and these are having no effect on night since they are disappeared (due to recombination of ionosphere into molecules).

07. Ans: (a)

Sol:

- D-layer is the lowest layer of the ionosphere as shown in figure.
  D-layer range is 50-90 km and it exists at an average height of 70km.

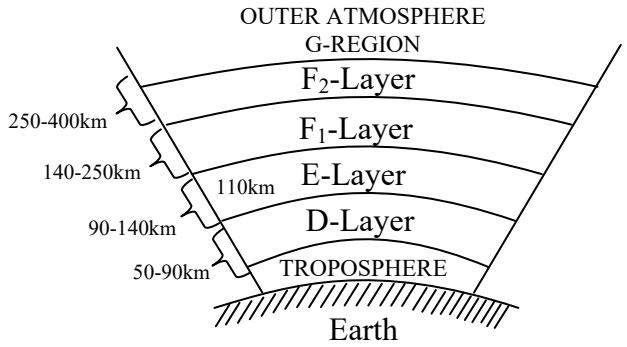


Fig. Typical heights of ionospheric layers above earth

08. Ans: (b)

Sol:

- The phenomenon of propagating microwave signals around the curvature of the earth over a distances upto 1000km is known as "Duct propagation" as shown in figure.
- Duct propagation phenomenon occurs mostly at UHF and micro wave frequencies.

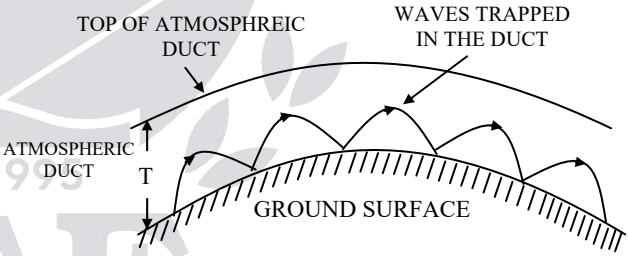


Fig. super-refraction in the atmospheric duct

- The temperature inversions cause ducts, of cool air to be sandwiched between surface of the earth and a layer of warm air.
- Duct is formed in troposphere.

09. Ans: (d)

Sol:

- During daytime F-layer will not present since it splits into two layers F_1 and F_2 as shown in figure.

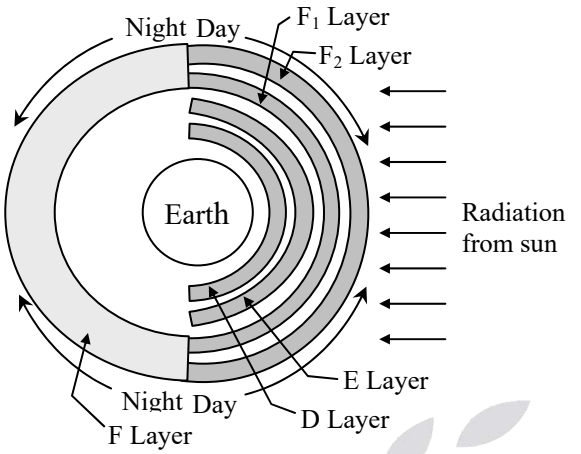


Fig: Different layers of Ionosphere during day and night

10. Ans: (c)

Sol:

- The refractive index of the ionized layer is,

$$n = \sqrt{1 - \frac{81N}{f^2}}$$

Where, N → electron density

F → plasma frequency

11. Ans: (b)

Sol:

- MUF (Maximum usable Frequency) is the maximum frequency that can be reflected back to the earth by the ionosphere other than vertical incidence.

i.e., $F_{MUF} = f_c \sec\phi$

where, ϕ is a angle of incidence f_c is a critical frequency.

$F_{MUF(max)} = 3.6\ f_c$

12. Ans: (c)

Sol: Critical frequency is the highest frequency that can be reflected back by the particular layer of ionosphere for vertical incidence.

For a vertical incidence, the angle of incidence becomes zero and the electron density becomes maximum.

$$\Rightarrow n = \sqrt{1 - \frac{81N_{max}}{f_c^2}} = 0$$

$$\therefore f_c = 9\sqrt{N_{max}}$$

13. Ans: (c)

Sol:

- Ionosphere is divided into different layers and each of the layer exhibits different characteristics as shown in figure below.
- The density of the layers increases until noon and then decrease slowly throughout the afternoon since ionization depends on the radiation from the sun.
- During day time ionosphere consists of D, E, F_1 and F_2 layers as shown in figure.

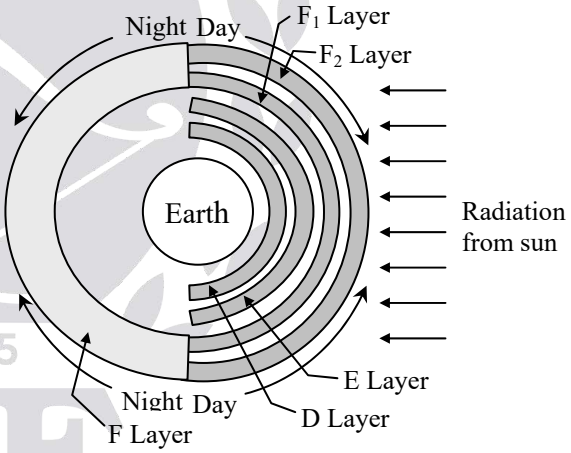


Fig: Different layers of Ionosphere during day and night

14. Ans: (a)

Sol:

- The absorption of electromagnetic waves by the atmosphere depends on the frequency of the waves.
- The absorption of some of it's energy of electromagnetic wave is more for high frequency waves than low frequency waves.

15. Ans: (a)

Sol:

- Skip distance is the minimum distance from the transmitter at which a sky wave of given frequency is returned to the earth by ionosphere.
- Skip distance depends on the wave's frequency and angle of incidence, and the degree of ionization.
- The wave of lower frequency is bent round more quickly than the wave of higher frequency. Therefore higher the frequency, the higher the skip distance.

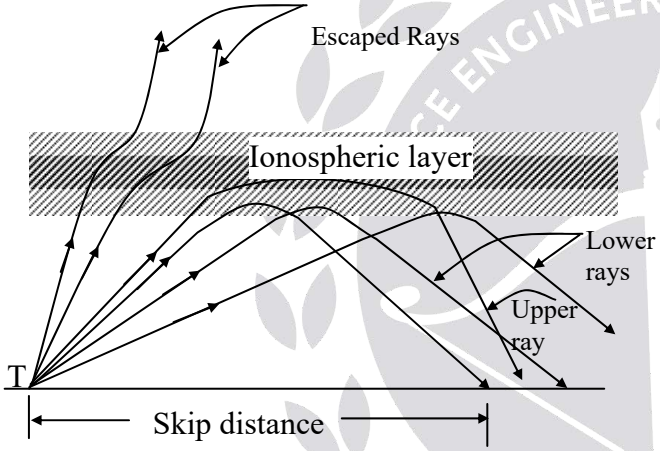


Fig: Effects of ionosphere on rays of varying incidence.

16. Ans: (c)

Sol:

- VLF band is in the range of 3kHz to 30kHz and wavelengths from 10 to 100 kilometers.
- VLF waves required low power to transmit because of this they are used for a few radio navigation services, government time radio stations and for secure military communications.

17. Ans: (d)

Sol:

- Refraction is the change in direction of propagation of a wave due to a change in its transmission medium.
- Due to change in medium, the phase velocity of the wave is changed but its frequency remains constant.
- This is most commonly observed when a wave passes from one medium to another at any angle other than from the normal.
- We are observing same as mentioned in above points in ionospheric propagation.

18. Ans: (d)

Sol:

- Troposcatter propagation is of practical importance at VHF, UHF and microwaves.

19. Ans: (c)

Sol:

- Scatter propagation is possible in the VHF and UHF bands and it propagated much beyond the line-of-sight propagation through the forward scattering in the tropospheric irregularities, as shown in figure

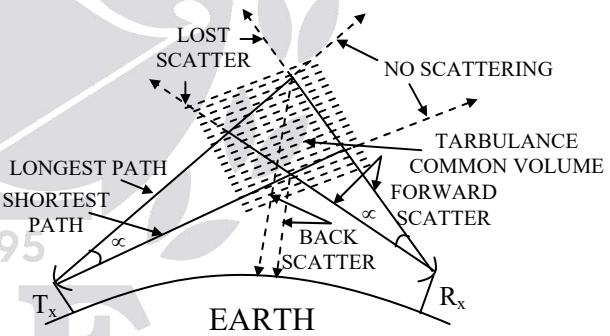


Fig. Tropospheric scatter propagation

20. Ans: (c)

Sol:

- In night, few layers of ionosphere (D, E, F_1 & F_2) are disappeared due to recombination of ions into molecules.
- Because of this reason, the effect of these layers on HF band frequencies is not present.
- So, we are getting better HF reception at night.

21. Ans: (a)

Sol:

- Given, Critical frequency (f_c) = 30MHz
  Angle of incidence (ϕ) = 60°
  We know, $f_{(MUF)} = f_c \sec\phi$
  $= (30M)(\sec 60°)$
  $= 60MHz$

22. Ans: (d)

Sol:

- Upto MHz frequency range is more reliable in terrestrial communications beyond-the-horizon without repeaters. Hence, option (d) is the correct answer

23. Ans: (b)

Sol:

- Ground waves can travel maximum few hundred km, after that they are attenuated.
- Space wave propagation is limited to the line-of-sight distance and also limited by the curvature of the earth.
- Troposcatter wave propagation is much beyond the line-of-sight distance through forward scattering in the tropospheric irregularities for UHF and microwave signals.
- Ionospheric waves are used at high frequencies for very long distance communications.

  Actually the correct order is 3, 1, 2, 4 but out of these options option (b) is more suitable

24. Ans: (d)

Sol:

- At high frequencies, ground wave propagating affected due to wave tilting since the orientation of the vertically polarized ground wave is changing close to horizontal polarization.
- So, at high frequency the ground wave attenuation by ground is much more than at low frequency over the same ground as shown in figure
- LF communication signals are used at low power.

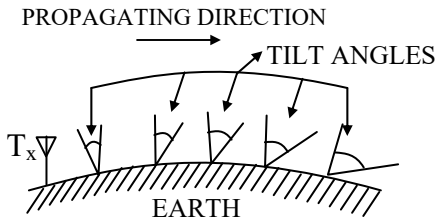


Fig. Tilting wave fronts in ground wave propagation

25. Ans: (c)

Sol:

- Given, Transmitting antenna height (h_t) = 196 meters
  Radio horizon (km) = $4.12\sqrt{h_t(\text{meters})}$
  $= 4.12\sqrt{196}$
  $= 4.12 \times 14$
  $\therefore$ Radio horizon (km) = 57.68km

26. Ans: (b)

Sol:

- In microwave terrestrial LOS link, the space wave propagation is limited to the the line of sight distance and is also limited by the curvature of the earth.
- So, the location of the next repeater in this propagation is also limited by curvature of the earth

27. Ans: (a)

Sol:

- Given, Height of transmitting and receiving antenna (h_t & h_r) = 25m
  Maximum hop length (dkm) $\cong 4\left(\sqrt{h_t}+\sqrt{h_r}\right)$
  $\Rightarrow d_{km} \cong 4\left[\sqrt{25}+\sqrt{25}\right]$
  $\cong 4(10)$
  $\therefore d_{km} \cong 40km$

28. Ans: (c)

Sol:

- The ionosphere acts like a reflecting surface and is able to reflect back EM waves of frequencies between 2 to 30MHz. EM waves of frequency more than 30 MHz are not reflected back from the ionosphere rather they penetrate through it.

- Here, the EM wave frequency is 60MHz, then a communication link spanning a distance of 600km cannot be established at 60MHz via the ionosphere because the 60MHz wave is not reflected by any of the layers of ionosphere.

29. Ans: (a)

Sol:

- In day time the ionospheric layers (D, E, F_1 & F_2) are present and the signal absorption in the lowers (D & E) is more.
  Where as in night these layers are disappeared, then the signal quality is poor in day compared to night.

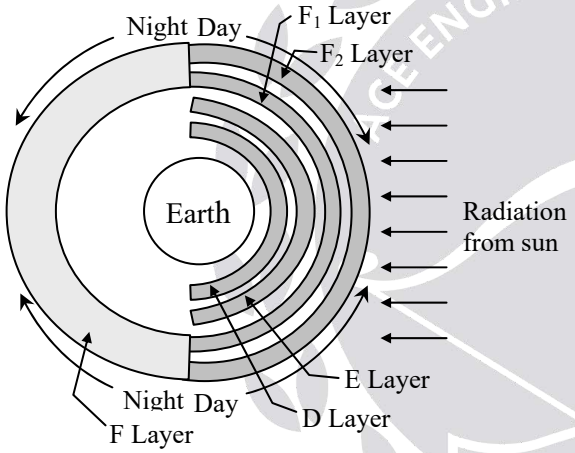


Fig: Different layers of Ionosphere during day and night

30. Ans: (d)

Sol:

- Ground wave propagation is suitable for low and medium frequency i.e., upto 2MHz only.
- Sky wave propagation is suitable for medium and high frequencies i.e,, between 2 to 30MHz only.
- Space wave propagation is suitable for very high frequencies (VHF), UHF and microwaves i.e., between 30M to 30MHz only.
- Troposcatter wave propagation is suitable for VHF, UHF and microwave signals beyond the line of sight distance and the range is above 300MHz.
  Hence, option (d) is correct.

Chapter 7 Satellite Communication

(Solutions for Vol-1_Classroom Practice Questions)

01. Ans: (d)

Sol: The height of a geostationary satellite above the Earth's surface is h = 35,855km (Approximately h ≅ 40,000km).

02. Ans: (d)

Sol: Given,

The height of geostationary satellite (h) = 36,000km

The down link frequency (f_{down}) = 10GHz

The up-link free space loss ($L_{up\text{-}link}$) = 1.583 dB + $L_{down\text{-}link}$

path loss in down-link,

$$(L_{up\text{-}link}) = \left(\frac{4\pi R}{\lambda}\right)^2$$

$$= 20\log\left(\frac{4\pi R}{\lambda}\right)$$

$$= 203.56 \text{ dB}$$

$\Rightarrow L_{up\text{-}link} = 1.583 + 203.56$

$\therefore L_{up\text{-}link} = 205.15$ dB

03. Ans: (c)

Sol:

- An active satellite amplifies the received signal and retransmits back to earth.
- A passive satellite reflects ratio signals back to the earth.

Hence, both statements are correct.

04. Ans: (b)

Sol: Given,

Distance between two stations (R) = 100km

The transmitted power (P_t) = 1kW

The operating frequency (f) = 100MHz

Directivity of two antennas (D) = 1.64

The maximum receiver power (P_r) = ?

$\Rightarrow$ Maximum directive gain of antennas (G) = directivity (D) = 1.64

We known,

Maximum receiver power,

$$(P_r) = \frac{P_t.G_{t,max}.G_{r,max}}{\left(\frac{4\pi R}{\lambda}\right)^2} = \frac{P_t D_t D_r}{\left(\frac{4\pi R}{\lambda}\right)^2}$$

$$\Rightarrow P_r = \frac{1\times10^3\times1.64\times1.64}{\left(\frac{4\pi\times100kt10^3}{3}\right)^2}$$

$$\left[\because \lambda = \frac{c}{f} = \frac{3\times10^8}{10^8} = 3m\right]$$

$\therefore P_r = 1.53 \times 10^{-8}$ W

05. Ans: (a)

Sol: Given,

P_t = 40dB W, L_{bo} = 3dB and L_{bf} = 3dB,

G_t = 4dB

The effective isotropic radiated power (EIRP) = $P_t - L_{bo} - L_{bf} + A_f$

$= 40 - 3 - 3 + 4$

$\therefore$ EIRP = 38 dBW

06. Ans: (b)

Sol:

- Geo-stationary satellite always appears stationary w.r.t to a point on the earth surface. So continuous communication is possible.
- In satellite communication, up-link and downlink frequencies are choosen different because to decrease the interference between up-link wave and down-link wave.

Hence, both statements are correct but statement-II is not correct explanation of statement-I.

07. Ans: (a)

Sol:

- A communication satellite is an active satellite which amplifies the received signal and retransmits them back to earth hence, it is also called repeater.

  Hence, both statements are correct and statement-II is the correct explanation of statement-I.

08. Ans: (b)

Sol:

- Geo-stationary satellite always appears stationary w.r.t to a point on the Earth surface. So continuous communication is possible.
- Because of this reason, geo-stationary orbit is most widely used for communication purpose.
- Because of it's altitude, it gives rise to long propagation delay.

  Hence, both statements are correct but statement-II is not correct explanation of statement-I.

09. Ans: (b)

Sol:

- Radio and television receivers are generally superhetrodyne. Since superhetrodyne receiver will decreases the effect of image frequency and decreases the distortion in wireless communication.
- Superhetrodyne receivers are better in selectivity.

  Hence, both statements are correct and statement-II is not correct explanation for statement-I.

10. Ans: (a)

Sol:

- If satellites in low, elliptical orbits used for global communication, may be distance between satellite and earth decreases but we required another communication system to track this satellite.
- Whereas in geo-stationary satellite is always synchronous with earth. So another tracking device is not required.

  Hence, both statements are correct and statement-II is correct explanation for statement-I.

11. Ans: (c)

Sol:

- The most probable bandwidth of a transponder in a satellite communication system is 36MHz.

Chapter 8 Optical Fiber Communication
(Solutions for Vol-1_Classroom Practice Questions)

01. Ans: (d)

Sol: Given,

Cladding material relative permittivity (ε_r) = 2.4375

$\Rightarrow$ Refractive index of the cladding material $(n_2) = \sqrt{\varepsilon_r}$

$= 1.561$

Numerical aperture (N.A) = 0.25

We know, $N.A = \sqrt{n_1^2 - n_2^2}$

Where n_1 = Refractive index of core material.

n_2 = Refractive index of cladding material

$\Rightarrow 0.25 = \sqrt{n_1^2 - (1.561)^2}$

$\therefore n_1 = \sqrt{2.5}$

02. Ans: (d)

Sol: Total number of modes in step index fiber $= \frac{V^2}{2}\left(\frac{\alpha}{\alpha+2}\right)$

Where,

α = Refractive index profile

= 1 for triangular profile

= 2 for parabolic profile

V = Normal frequency $= \frac{\pi d}{\lambda}(N.A)$

i.e., the total number of modes entering an optical fiber depends on core radius (r), wave length of the optical source (λ) and refractive index profile (α).

Hence, option (d) is correct.

03. Ans: (b)

Sol: Given, for a single mode optical cable

Attenuation per km = α (dB/km)

= 0.25 dB/km

We know,

$$\alpha(dB/m) = \frac{\log\left(\frac{P_i}{P_0}\right)}{L}$$

L = length of optical fiber = 100km

$$\Rightarrow 0.25 = \frac{10\log\left(\frac{0.1m}{P_0}\right)}{100}$$

$\therefore P_0 = -35$dBm

04. Ans: (c)

Sol:

- Numerical aperture (N.A) is used to describe the light gathering (or) light collecting ability of an optical fiber.
- The larger the magnitude of the numerical aperture, the greater the amount of external light the fiber will accept.

05. Ans: (c)

Sol:

- In a optical fiber, the refractive index of the cladding material should be always less than that of the core.
- Then only, the total internal reflection takes place in core of optical fiber.

06. Ans: (d)

Sol:

- Fibers with higher numerical aperture values generally exhibit greater losses and low bandwidth.
- In optical fiber numerical aperture band width product is constant.

07. Ans: (b)

Sol:

- To transmit a data at the rate of 1000Mbps, mostly we are going for optical fiber system.