# QUESTION BANK FOR SATELLITE COMMUNICATION

## UNIT I

### MAY 2009

**1)** Explain Kepler's laws. What are the fords that give rise to these laws? **10M**
2) Explain how a satellite is located with respect to earth. 10M
3) Describe antenna look angles and how are they calculated. 10M

### DEC 2009

1) Explain elevation angle and azimuth angle calculation with proper derivations. **10M**
2) Explain various types of orbital perturbations affecting the system. **10M**
3) A satellite is in 322-km high circular orbit Determine.
   i. Orbital angular velocity.
   ii. Orbital period.
   iii. Orbital linear velocity. **10M**

### June 2010

1) Explain briefly what is meant by sun transit outage. **10M**
2) Explain briefly Doppler effect. **10M**
3) Explain Kepler's three law of planetary motion. **10M**

### DEC 2010

1) Explain Kepler's laws of planetary motion. Give expression for each. **10M**
2) Define Look angles. Explain elevation angle and azimuth angle calculation giving proper expressions. **10M**
3) Explain various orbital effects in communication system performance. **10M**

### MAY 2011

1) Explain Kepler's Three law of planetary motion.
2) Explain how a satellite is located with respect to earth.
3) Explain briefly what is meant by sun transit outage.

### DEC 2011

1) What are the elements of a basic satellite communication system? Explain each with a suitable block diagram.
2) Define the following terms in brief
   a) Apogee b) perigee c) Live of apsides d) Ascending and descending nodes
   e) Live of nodes f) inclination angle g) Prograde and retrograde orbit
   h) Argument of perigee i) Right ascention of nodes j) Mean and True anomaly
3) What are the different orbital perturbations? Explain them briefly.

## UNIT II

### MAY 2009

1) What is meant by rain rate and effective path length? The earth station attitude is 600m, elevation angle is 50, rain height is 3 km find the slant height, effective path length and horizontal projection of slant height. **10M**
2) Explain how depolarization is caused by ionosphere rain and ice. **10M**
3) Explain in brief the antenna configurations used for satellite communication system. **10M**

**DEC 2009**

1) Explain various types of atmospheric losses what is cross polarization. **10M**
2) Generate a far field pattern for linear aperture type antenna. **10M**
3) Explain various types of depolarization. **10M**

**JUNE 2010**

1) Explain what is meant by effective path length in connection with rain attenuation. **10M**
2) Explain what is meant by cross-polarization discrimination and polarization solution. **10M**
3) Explain briefly parabolic reflector and also describe briefly the offset feed used with paraboloidal reflector antenna. **10M**

**DEC 2010**

1) On which factors the gain of an antenna is dependent? Calculate the far field pattern of a uniformly illuminated linear aperture antenna. **10M**
2) Explain the concept of polarization and depolarization. Discuss in detail any one type of polarization and depolarization. **10M**
3) Compare the propagation effects in aeronautical and land mobile satellite channels. **10M**

**MAY 2011**

1) What is meant by rain rate and effective path length? The earth station attitude is 600m, elevation angle is 40, rain height is 3km. find the slant height, effective path length and horizontal projection of slant height.
2) Explain what is meant by cross-polarization discrimination.
3) Describe briefly the offset feed used with paraboloidal reflector antennas, statimng its main advantages & disadvantages.

**DEC 2011**

1) Describe the major effects ionosphere has on satellite communication.
2) Explain what is meant by cross polarization discrimination.
3) Describe the offset feed used with paraboloidal reflector antenas stating its advantages and disadvantages.

**UNIT III**

**MAY 2009**

1) A 4 GHz receiver has the following parameters T antenna = 25K, $T_{RF}$ amplifier= 50 K, $T_{IF\ amplifier}$=1000 K, $T_{mixer}$ = 500K, $G_{RF\ amplifier}$ = 23 dB, $G_{IF\ amplifier}$ = 30 dB
   A) Calculate $T_S$ for $G_{mixer}$ = 0dB.
   B) Calculate $T_S$ for $G_{mixer}$ = 10dB.
   C) If the above system has LNA with a gain of 50 dB and lossy waveguide with an automation of 2 dB is inserted between antenna and RF amplifier, find $T_S$ for a waveguide temperature of $300^0$K. **10M**
2) Discuss the various design issues related with uplink design and give the Expression C/N ratio for the same. **10M**
3) Explain the CDMA technique used in satellite communication system. **10M**

**DEC 2009**

4) A hypothetical satellite network requires participating stations to have a minimum G/T ratio given by.
   $G/T = 40.7 + 20 \log_{10} (g/4)$ dB/k

Where value of 'g' is in GHz. Assume operation at 4GHz with terminal Consisting of antenna followed by waveguide with physical temperature 300k and 0.6 dB loss and a parametric amplifier with 1.0 dB standard noise figure & 15 dB gain. The paramp drives a mixel-pream with a 7 dB noise figure & 30 dB gain. After mixer-preamp is an if receiver with a 12 dB noise figure. Calculate antenna diameters in meters to meet G/T specification. (Antenna noise temperature is 15 K and aperture efficiency is 65%). **10M**

5) Compare FDMA, TDMA and CDMA. **10M**
6) What are the factors considered for uplink and downlink design. What is the significance of FM improvement factor. **10M**

**JUNE 2010**

1) Explain what is meant by saturation flux density. An uplink operates at 14 GHz and the flux density required to saturate the transponder is -120 db (w/m2). The free space loss is 207 db and the other propagation losses amount to 2 db. Calculate the earth station [EIRP] required for saturation, assuming clear sky condition assume [RFL] is negligible. **10M**
2) Explain link power budget equation. A satellite link operating at 14 GHz has receiver feeder losses of 1.5 db and a free space loss of 207 db. The atmospheric absorption loss is 0.5 db and the antenna pointing loss is 0.5 db. Depolarization losses may be neglected. Calculate the total link loss for clear sky conditions. **10M**
3) Explain with the help of appropriate diagram "Time division multiple access technique" used in digital satellite communication. What is the role of unique word? How is it used? **10M**

**DEC 2010**

1) What are the different factors considered for a link design of a satellite system? Derive Friis transmission equation for calculating the received power in any radio link. **10M**
2) Compare FDMA, TDMA and CDMA techniques. **10M**
3) What is the voice channel capacity of a TDMA system with the following characteristics?
   Transmission bit rate= 60 Mbps
   Voice Channel bit rate = 64Kbps
   Number of burst/frame=10
   Number of bit/each preamble=150.
   Frame Time =750 µsec. **10M**

**MAY 2011**

1) Explain clearly the satellite system link equation with all terms involved therein. a satellite link operating at 14GHz has receiver feeder losses of 1.5dB and free space loss of 207 dB. The atmospheric loss is 0.5dB and antenna pointing loss is 0.5dB. depolarization losses may be neglected. Calculate the total link losss or clear sky condition.
2) Discuss the various design issues related with uplink design and give the expression C/N ratio for the same.
3) Explain the TDMA technique used in satellite communication system. What is role of unique word? How is it used?

**DEC 2011**

1) Derive the expression for an overall system noise temperature at the receiving earth station.

2) Complete the downlink budget for a satellite system with the following parameters.
   a) Satellite transmitter o/p power at saturation, 10W=10dBW.
   b) Satellite back off loss= 0.1dB.
   c) Satellite branching and feeder losses = 0.5dB.
   d) Satellite transmit antenna gain (0.37m at 12GHz) = 28.8dB.
   e) Additional downlink atmospheric losses = 0.4dB.
   f) Free space path loss (at 12GHz) =201.6dB.
   g) Earth station receive antenna gain (15m, at 12GHz) = 62dB.
   h) Earth station branching and feeder losses = 0dB.
   i) Earth station equivalent temperature = 270K.
   j) Earth station G/T ratio = 37.7dBK$^{-1}$.
   k) Bit rate = 120Mbps.
   l) Modulation scheme = 8-PSK.
3) Explain the TDMA frame structure of satellite system.

**UNIT IV**

**MAY 2009**

1) What is transponder and explain its various sections. **10M**
2) Explain TT&C subsystem of satellite. **10M**
3) Explain the general configuration of an earth station **10M**

**DEC 2009**

1) Explain attitude and orbital control system with proper bock diagram. **10M**
2) Explain telemetry, tracking and command system. **10M**
3) Explain earth station design for low system noise temperature. **10M**

**JUNE 2010**

1) What is transponder ? Explain with a neat diagram working of a basic transponder.? What are the function of front end receiver.? **10M**
2) Discuss design aspect for communication satellite . Explain lifetime reliability.**10M**
3) What are the main consideration in the design of an earth station.? Explain general configuration of an earth station. **10M**

**DEC 2010**

1) Explain single conversion and double conversion transponder system. **10M**
2) Discuss the different types of factors considered for designing of earth station. **10M**
3) Explain the techniques used for attitude control in AOCS subsystem of satellite. **10M**

**MAY 2011**

1) What is transponder and explain its various sections.
2) Discuss design aspect for communication satellite. Explain lifetime and reliability.
3) What are the main consideration in the design of earth station? Explain general configuration of an earth station.

**DEC 2011**

1) Write a short note on
   a) Single conversion transponder (bent pipe).
   b) Double conversion transponder (bent pipe).
2) Explain the attitude and orbit control system present in the space segment.
3) Describe the various subsystems of earth station.

## UNIT V

### MAY 2009

1) Write a short note on VSAT or GPS. **10M**
2) Explain DBS satellite system. **10M**
3) What are the types of non-geostationary satellite orbits and explain their advantages and disadvantages. **10M**

### DEC 2009

4) Explain the use of satellite in remote sensing applications in details. **10M**
5) How video conferencing is possible with the application of satellite. **10M**
6) How satellite can be used for video Receive only system. **10M**

### June 2010

1) What are the types of non geostationary orbit satellite.? Give their advantages, disadvantages, and applications. **10M**
2) Explain INTELSAT series, in details. **10M**
3) Explain the services provided by GSM. **10M**

### DEC 2010

1) Explain what is network issue. What are the different types of network architectures used in satellite communication. **10M**
2) How video conferencing is possible using a satellite? Explain with proper sketch. **10M**
3) Explain the use of satellite in remote sensing application. **10M**

### MAY 2011

1) What are the types of non-geostationary satellite orbits and explain their advantages and disadvantages.
2) Write a short notes on GSM or VSAT.
3) Explain mobile satellite services.

### DEC 2011

1) Write a short notes on INSAT.
2) Explain GEO, MEO and LEO satellite.
3) Explain the video conferencing system using satellite.