



Sixth Semester B.E. Degree Examination, June-July 2009
Satellite Communication

Time: 3 hrs.

Max. Marks:100

- Note: 1. Answer any FIVE full questions, selecting at least TWO questions from each part.**
2. Standard notations are used.
3. Assume any missing data suitably.

PART – A

- 1 a. Explain the services provided by satellites. (05 Marks)
- b. Calculate the radius of a circular orbit for which the period is 1 day. (05 Marks)
- c. Explain the following terms
 - i) Argument of perigee
 - ii) Right Ascension of ascending node
 - iii) Inclination
 - iv) Prograde and Retrograde orbits. (10 Marks)
- 2 a. A satellite has eccentricity of 0.14452 and is given by NASA prediction bulletin as 9.5981×10^{-3} and mean anomaly at epoch as 204.9779° . The mean motion is 14.2171404 revolutions / day. Calculate the true anomaly and the magnitude of radius vector 5 secs after the epoch. The semimajor axis is known to be 7194.9km. (07 Marks)
- b. A geostationary satellite is located at 80°W . Calculate the azimuth angle for an earth station antenna at latitude 35°N and longitude 90°W . (05 Marks)
- c. Explain the phenomenon Earth eclipse of satellite and sun transit outage. (08 Marks)
- 3 a. Explain Atmospheric losses and Ionospheric losses for satellites. (08 Marks)
- b. An antenna has a noise temperature of 40°K and is matched into a receiver which has a noise temperature of 100°K . Calculate i) Noise power density; ii) Noise power for a bandwidth of 46 MHz. (05 Marks)
- c. Explain carrier to Noise Ratio of a satellite link. (07 Marks)
- 4 a. Explain attitude control of a satellite. (07 Marks)
- b. Explain how station keeping is done in satellites. (07 Marks)
- c. With the help of a neat diagram explain wideband receiver of a Transponder. (06 Marks)

PART – B

- 5 a. Explain MATU system. (07 Marks)
- b. What is the channeling scheme used for the spade system? Explain. (07 Marks)
- c. Explain preassigned TDMA with an example (CSC). (06 Marks)
- 6 a. Compare the uplink power requirements for FDMA and TDMA. (07 Marks)
- b. A downlink $\left[\frac{C}{N_0} \right]$ is 87.3dBH_2 for a TDMA circuit that uses QPSK modulation. A BER of 10^{-5} is required. Calculate the maximum transmit rate. Also calculate the IF bandwidth required assuming a roll off factor of 0.2 and $\frac{E_b}{N_0} = 9.5\text{dB}$ for $\text{BER} = 10^{-5}$. (06 Marks)
- c. Briefly explain satellite switched TDMA. (07 Marks)
- 7 a. Explain the following
 - i) Transponder capacity
 - ii) Bit rate for Digital Television. (08 Marks)
- b. Explain in detail the satellite mobile services. (12 Marks)
- 8 a. What is VSAT? Explain. (08 Marks)
- b. Explain the following:
 - i) GPS
 - ii) Radarsat. (12 Marks)

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Sixth Semester B.E. Degree Examination, Dec.09/Jan.10
Satellite Communication

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting at least TWO questions from each part.

PART - A

- 1 a. Explain clearly the Kepler's laws of planetary motion. Express the third law in the form $a^3 = \frac{\mu}{n^2}$. Specify the quantities a, μ and n with precise units. (09 Marks)
- b. A satellite in an elliptical orbit has a perigee of 1000km and apogee of 4000km. If the mean earth radius is 6371km, find the period of the orbit in minutes. (06 Marks)
- c. Define the following terms as applicable to orbiting satellites :
i) Line of apsides ii) Ascending node iii) Prograde orbit
iv) Argument of perigee v) Mean anomaly. (05 Marks)
- 2 a. What is orbit perturbation? Explain with relevant differential equations, the regression of nodes and the rotation of apsides. (07 Marks)
- b. Explain with the help of a neat diagram, the polar mount antenna. (06 Marks)
- c. An earth station is located at a latitude of 12°S and longitude 52°W. Calculate the antenna look angles for a satellite at 70°W. Assume radius of earth = 6371km and $a_{GSO} = 42,164$ km. (07 Marks)
- 3 a. What is meant by EIRP? Show that the received power in a satellite link can be expressed as $[P_R] = [EIRP] + [G_R] - [FSL]$,
where $[P_R]$ = Received power in dBW
 $[EIRP]$ = Equivalent isotropic radiated power in dBW
 $[G_R]$ = Gain of the receiving antenna in dB
 $[FSL]$ = Free space loss in dB. (08 Marks)
- b. Explain what is meant by :
i) Antenna noise temperature ii) Amplifier noise temperature
iii) System noise temperature referred to input. (06 Marks)
- c. A LNA is connected to a receiver which has a noise figure of 12dB. The gain of the LNA is 40dB, and its noise temperature is 120°K, calculate the overall noise temperature referred to the LNA input. (06 Marks)
- 4 a. What is attitude control as applicable to satellites? Explain with the help of a diagram, spin stabilization of satellites. (08 Marks)
- b. What is a satellite transponder? With a neat diagram, explain the overall frequency arrangement of a typical c-band communication satellite. (08 Marks)
- c. Explain briefly the need for TTC in satellite systems. (04 Marks)

PART - B

- 5 a. With a neat diagram, explain the outdoor and indoor units of a receive-only home T.V. system. (10 Marks)
- b. What is meant by preassigned FDMA? With a neat diagram, explain single channel per carrier (SCPC) in INTELSAT for a 36 MHz transponder. (10 Marks)

Important Note: 1. On completing your answers compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+0.50, will be treated as malpractice.

- 6 a. What is meant by TDMA? Explain the need for reference burst. Explain briefly the different components of a reference burst. (10 Marks)
b. With a neat diagram, explain digital TASI. (10 Marks)
- 7 a. With respect to direct broadcast satellite services, explain :
i) Orbital spacing ii) Power rating of transponders
iii) Frequency of operations iv) Polarization (08 Marks)
b. With a neat diagram, explain the salient features of MPEh – 2 compressor used in digital transmission of video in satellites. (12 Marks)
- 8 a. What is mobile satellite service? Explain briefly any two such systems. (10 Marks)
b. Explain briefly :
i) VSAT and its applications ii) GPS and its uses. (10 Marks)

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Sixth Semester B.E. Degree Examination, May/June 2010
Satellite Communication

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting
at least TWO questions from each part.**

PART – A

- 1
 - a. Explain briefly the various services provided by a satellite. (06 Marks)
 - b. State Kepler's three laws of planetary motion, with the help of a neat diagram and give necessary equations. (08 Marks)
 - c. Define Keplerian elemental set. (06 Marks)
- 2
 - a. An earth station is located at latitude 30° S and longitude 65° E. Calculate the antenna look angles for the satellite at 156° E. (08 Marks)
 - b. Briefly explain the launching orbits for a geostationary satellite. (06 Marks)
 - c. A quasi-geo satellite is in a circular equatorial orbit, close to the geosynchronous attitude. Its orbital period is exactly 24 hours, one solar day. Calculate:
 - i) The radius of the orbit
 - ii) The rate of drift around the equator of the subsatellite point in degree/solar day. An observer on the earth sees that the satellite is drifting across the sky.
 - iii) Is the satellite moving towards the east or towards the west? (06 Marks)
- 3
 - a. For satellite transmission $EI = 22^\circ$, $R_{0.01} = 15$ mm/h, $h_0 = 600$ m, $h_R = 1500$ m. Calculate rain attenuation for vertical polarization at an operating frequency of 14 GHz. ($a_v = 0.0335$, $b_v = 1.128$). (07 Marks)
 - b. Explain the different transmission losses in a satellite link. (07 Marks)
 - c. Define saturation flux density. Obtain the equation for saturation EIRP for uplink. (06 Marks)
- 4
 - a. What is meant by satellite altitude? Briefly describe three axis method of satellite stabilization. (07 Marks)
 - b. With the help of a neat diagram, explain TTC and M subsystem. (07 Marks)
 - c. What is meant by frequency reuse? Briefly describe the working of a wide band receiver. (06 Marks)

PART – B

- 5
 - a. With a neat block diagram, explain the outdoor and indoor unit for analog FM/TV. (12 Marks)
 - b. Explain the spade system, with a neat diagram. (08 Marks)
- 6
 - a. With a neat diagram, explain frame and burst formats for a TDMA system. (07 Marks)
 - b. Explain the working of carrier recovery circuit with single tuned circuit having AFC. (07 Marks)
 - c. Determine : i) Miss probability for the values $N = 4$, $E = 5$, $P = 10^{-3}$.
ii) False detection for the values $N = 40$, $E = 5$. (06 Marks)
- 7
 - a. Calculate the bit rate that can be carried in the 36 MHz channel using QPSK, allowing a roll-off factor of 0.2. (05 Marks)
 - b. Explain the very small aperture terminal system. (08 Marks)
 - c. Give the applications of Radar Sat. Explain a 'dawn to dusk' orbit. (07 Marks)
- 8
 - a. Explain the global positioning system, in detail. (08 Marks)
 - b. Write short notes on : i) System noise temperature ii) Preassigned FDMA. (12 Marks)

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