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06EC662

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 $a^3 = \mu/n^2$. 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 anamoly. **(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} = 42,164km. **(07 Marks)**

3 a. What is meant by EIRP? Show that the received power in a satellite link can be expressed as $[P_R] = [EIPR] + [G_R] - [FSL]$,
where $[P_R]$ = Received power in dBW
[EIRP] = Equivalent isotropic radialed 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)**

6 a. What is meant by TDMA? Explain the need for reference burst. Explain briefly the differe components of a reference burst. (10 Mark

b. With a neat diagram, explain digital TASI. (10 Mark

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 Mark

b. With a neat diagram, explain the salient features of MPEh – 2 compressor used in digit transmission of video in satellites. (12 Mark

8 a. What is mobile satellite service? Explain briefly any two such systems. (10 Mark

b. Explain briefly :
i) VSAT and its applications ii) GPS and its uses. (10 Mark

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06TE63

Sixth Semester BE Degree Examination, Dec.09-Jan.10
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. Missing data be suitably assumed.

PART – A

1 a. Explain the principle of ground wave propogation. What is sommerfield analysis of ground-wave propogation? **(06 Marks)**

b. Derive an expression for far field strength, due to space wave, in terms of the heights of transmitting and receiving antenna and also field strength at unit distance. **(10 Marks)**

c. Calculate the radio horizon for a 100 mts transmitting antenna and a receiving antenna of 25 mts. **(04 Marks)**

2 a. i) Explain what is an Ionosphere propogation.
ii) With a diagram, explain the structure of Ionosphere. **(06 Marks)**

b. i) Define maximum usable frequency.
ii) Derive an expression for calculation of MUF. **(08 Marks)**

c. Determine the change in the electron density of E-layer, when the critical frequency changes from 3 to 1.5 MHz between mid-day and sunset? **(06 Marks)**

3 a. What are the advantages and shortcomings of satellite communication? **(06 Marks)**

b. Explain the following terms with relevant diagrams:
i) Apogee ; ii) Perigee ; iii) Lines of nodes ; iv) Inclinaiton ; v) Mean anamoly ; vi) Right ascension of the ascending node. **(06 Marks)**

c. A satellite is in an elliptical orbit with a perigee of 1000 km and an apogee of 4000 km. Using a mean earth radius of 6378.14 km, determine the period of the orbit in hours, mts and secs and also find the eccentricity of the ellipse. (Given $\mu = 3.986 \times 10^3$ km/sec^2). **(08 Marks)**

4 a. Explain the following terms:
i) Geosynchronous orbit
ii) Geostationary orbit
iii) Sun – synchronous orbit **(06 Marks)**

b. Explain look angle determination. With neat figs explain,
i) Azimuthal angle
ii) Elevation angle
iii) Sub-satellite point **(08 Marks)**

c. The longitude and latitude of an earth-station are 76° degrees east and 13 degrees north. Find the azimuth and elevation angle from this station. **(06 Marks)**

PART – B

5 a. What are the factors that affect the orbiting path and altitude? Elaborate methods of statio keeping. **(08 Marks)**

b. What are the major sub-systems of a satellite? Explain their role with particular reference t a communication satellite. **(12 Marks)**

6 a. What are the different losses that a propogaitng wave suffers in the case of a satellite link Explain in detail, highlighting the choice of window frequencies. **(08 Marks)**

b. What is the relation between carrier to noise ratio and signal to noise ratio in a F.M receive signal? What is meant by F.M threshold? **(04 Marks)**

c. An earth station receives an R.F power of – 92 dB watts at 12.52 GHz. The earth station is a a slant range of 38,900 km from a geo-stationary satellite. What is the input power to the satellite antenna system, having a dish of 2 metre diameter and an efficiency of 70%? The other losses are coupling loss 5 dB and atmospheric loss 12 dB. **(08 Marks)**

7 a. What are the different multiple access techniques and schemes used is space communication? Bring out the comparison between them. **(10 Marks)**

b. What is "Back – off" in F.D.M.A? Explain. **(04 Marks)**

c. For a direct sequence C.D.M.A. calculate the processing gain in the care of a transmitter of 4 kHz tone on BPSK which occupies full 36 MHz bandwidth of the transponder. The filter used in the transponder has a roll – off of 0.2. Also calculate the $E_{b/No}$ if 60 channels access the transponder simultaneously. **(06 Marks)**

8 Write short notes on:

i) C.A.T.V
ii) S.C.P.C
iii) Direct broad cast satellite for T.V
iv) G.P.S. **(20 Marks)**

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06EC662

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 $\left[C/N_o\right]$ is $87.3 dBH_2$ 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 $\frac{E_b}{N_o} = 9.5dB$ for 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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06TE63

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. *Missing data be suitably assumed.*

PART – A

1 a. What is Diffraction? Derive an expression for knife-edge diffraction gain in dB. **(08 Marks)**

b. Briefly explain the four phenomena of radio wave propagation. **(06 Marks)**

c. A free space LOS microwave link operating at 10 GHz consists of a transmit and receive antenna with $G_t = G_r = 25$ dB. The distance between two antenna's is 30 KM and power radiated is10W. Calculate the path loss and received power. **(06 Marks)**

2 a. Derive an expression for the relative dielectric constant of the Ionosphere in terms of N and f. **(08 Marks)**

b. Briefly discuss about the Tropospheric Scatter. **(06 Marks)**

c. Explain with the help of suitable diagram the skip distance. **(06 Marks)**

3 a. Explain briefly the development and functions of INTELSAT. **(06 Marks)**

b. With suitable diagram explain various definitions of terms used to describe the position of the orbit with respect to the Earth. **(10 Marks)**

c. A satellite is orbiting in two equatorial plane with a period from perigee to perigee of 12h. If the eccentricity is 0.002, calculate semi major axis. Assume the earth's equatorial radius as 6378.1414 km, $K_1 = 66063.1704$ km^2 and $\mu = 3.986005 \times 1014$ m^3/s^2 **(04 Marks)**

4 a. Explain what is meant by the earth eclipse of an earth - orbiting satellite, with suitable diagram? **(08 Marks)**

b. What is meant by Geostationary Orbit? Why there is only one geostationary orbit? Explain. **(08 Marks)**

c. Determine the angle of tilt required for a polar mount used with an earth station at a latitude 49^0 North. Assume spherical earth of mean radius 6371 km and ignore earth station altitude. $b = \lambda E$, $aG_{so} = 42614$ km **(04 Marks)**

PART – B

5 a. Explain what is meant by EIRP? A transmitter feeds a power of 10W into an antenna which has a gain of 46 dB. Calculate the EIRP in dBW. **(08 Marks)**

b. Explain rain rate and effective path length in connection with rain attenuation. **(08 Marks)**

c. A satellite link operating at 14 GHz has a receiver feeder loss of 1.5 dB and free space loss of 207 dB. The atmospheric absorption loss is 0.5dB and antenna pointing loss is 0.5dB. Depolarisation losses are neglected. Calculate the total link loss for clear sky conditions. **(04 Marks)**

6 a. Describe TT and C facilities of a satellite communication system with the help of a neat block diagram. **(08 Marks)**

b. Explain what is meant by satellite attitude and briefly describe two forms of attitude control. **(08 Marks)**

c. Explain the three-axis method of satellite stabilization. **(04 Marks)**

7 a. Explain with the help of a neat block diagram of home terminal for DBS TV/FM reception. **(10 Marks)**

b. Bring out the comparison between MATV and CATV systems. **(10 Marks)**

8 a. Explain in detail the operation of the spade system of demand assignment. What is the function of the common signaling channel? **(08 Marks)**

b. Bring out a comparison between FDMA and TDMA with respect to their up link power requirements. **(06 Marks)**

c. Explain briefly satellite-switched TDMA. **(06 Marks)**

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