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10EC662

Sixth Semester B.E. Degree Examination, June/July 2017

Satellite Communication

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the services provided by a satellite. **(06 Marks)**

b. State and explain Kepler's three laws of planetary motion and give necessary equations. **(08 Marks)**

c. Define the terms:
i) Retrograde orbit and prograde orbit
ii) Mean anomaly and true anomaly
iii) Ascending and descending node. **(06 Marks)**

2 a. Calculate the semimajor axis for the satellite parameter NN = 14.23304826 day^{-1} and explain the phenomenon Earth eclipse of satellite. Assume $\mu = 3.986005 \times 10^{14}$ m^3/s^2. **(08 Marks)**

b. Calculate the apogee and perigee heights for the orbital parameters e = 0.0011501 and a = 7192.335 km. Assume a mean earth radius of 6371 km. **(03 Marks)**

c. Define Sidereal day and Solar day. **(02 Marks)**

d. A geostationary satellite is located at 90°W. Calculate the azimuth angle for an earth station antenna at latitude 35°N and longitude 100°W. Also find the range and antenna elevation angle. Assume radius of orbit a_{450} = 42164 km and the average radius of earth R = 6371 km. **(07 Marks)**

3 a. A QPSK signal is transmitted by a satellite. Raised-Cosine filtering is used, for which the roll off factor is 0.2 and BER of 10^{-5} with $[E_b/N_o]$ = 9.6 dB is required. For the satellite downlink, the losses amount to 200 dB the receiving earth station G/T ratio is 32 dBK^{-1}, and the transponder bandwidth is 36 MHz. Calculate: i) the bit rate which can be accommodated, and ii) the EIRP required. Assume K = -228.6 with losses 200 in dB. **(06 Marks)**

b. Explain carrier to noise ratio of a satellite link. **(07 Marks)**

c. Show that the rain attenuation in decibels is given by $A_p = aR_p^b L_s r_p$ dB. **(07 Marks)**

4 a. Explain momentum wheel stabilization of satellite. **(06 Marks)**

b. Explain how station keeping is done in satellites. **(06 Marks)**

c. What is transponder of satellite and with a neat diagram, explain wideband receiver of satellite transponder. **(08 Marks)**

PART – B

5 a. With the help of a block diagram, explain transmit-receive earth station. **(08 Marks)**

b. Describe briefly the modes of interference that can occur in a satellite communication system. **(06 Marks)**

c. What is master antenna TV system? With the help of a diagram, describe an arrangement for MATV system. **(06 Marks)**

6 a. A 14 GHz uplink operates with transmission losses and margins totaling 212 dB and a satellite (G/T) = 10 dB/K. The required uplink $[E_b/N_o]$ is 12 dB.
   i) Assuming FDMA operation and an earth station uplink antenna gain of 46 dB, calculate the earth station transmitter power needed for transmission of a T1 baseband signal.
   ii) If the down link transmission rate is fixed at 74 dBb/s, calculate the uplink power increase required for TDMA operation. For T1 bit rate is 1.544 Mb/s or $[R_b]$ = 62 dBb/s, K = –228.6. **(06 Marks)**

   b. Explain the following methods in demand-assigned FDMA:
   i) Polling method
   ii) Centrally controlled random access. **(04 Marks)**

   c. Explain on-board signal processing for FDMA/TDM operation. **(10 Marks)**

7 a. Calculate the bit rate that can be carried in the 24 MHz channel using QPSK, allowing a roll off factor of 0.2. **(04 Marks)**

   b. With respect to direct broadcast satellite service, explain the following:
   i) Orbital spacing
   ii) Power rating of transponder
   iii) Frequencies and polarization **(08 Marks)**

   c. Explain the following:
   i) Transponder capacity
   ii) Bit rate for digital TV **(08 Marks)**

8 a. Explain a very small aperture terminal system. **(08 Marks)**

   b. Write short note on:
   i) Radarsat
   ii) Global positioning system **(12 Marks)**

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