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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2014

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Eighth Semester

EC 9031 SATELLITE COMMUNICATION

(Regulation R-2008)

Time: 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. State Kepler's second law of planetary motion.
2. The earth rotates once per sidereal day of 23 hours 56 min 4.409 s. Show that the radius of the GEO is 42,164.17 km. $\mu=3.9 \times 10^5 km^3/s^2$.
3. What is meant by input back off of a transponder?
4. An uplink operates at 14 GHz, and the flux density required to saturate the transponder is 120dB (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 conditions. Assume {RFL} is negligible.
5. A satellite is operated at an EIRP of 64 dBW with an output BO of 7 dB. The transmitter feeder losses amount to 4 dB and the antenna gain is 60 dB. Calculate the power output of the TWTA required for full saturated EIRP.
6. What is polarization interleaving?
7. Distinguish between DAMA and PAMA.
8. What are the limitations of FDMA-satellite access?
9. What is dilution of precision?
10. Define remote sensing. How does a satellite find its use in Remote Sensing?

PART-A (5 x16 = 80 Marks)

11.(i) Define look angle, Azimuthal angle and elevation angle and determine elevation angle calculation with necessary diagrams **(8)**

(ii) The space shuttle is an example of a low earth orbit satellite. It orbits at an altitude of 250km above the earth's surface. The earth's radius is 6371.14 km. Calculate the period of shuttle orbit at an altitude of 250km and orbit is circular. Find also the linear velocity of the shuttle. **(4)**

(iii) A satellite is in elliptical orbit with a perigee of 1200km and an apogee of 3800. The man earth radius is 6378.14km.Find the period in hours, minutes and seconds. **(4)**

12.(a)(i) Draw the block diagram of a Satellite Control System and Explain in Detail about the wide band receivers used in transponders with necessary diagrams. **(8)**

(ii) Explain the effects of rain on link performance and thus bring out the equation governing uplink and downlink rain fade margin. **(8)**

OR

12.(b)(i) How does the system noise temperature affect the performance? Derive the expression for overall system noise temperature at the receiving earth station. **(8)**

(ii) A QPSK signal is transmitted by a satellite. Raised cosine filter is used with a roll off factor of 0.2 and bit error rate of 10^{-5} .For satellite downlink the losses amount to 250 dB, the receiving earth station G/T ratio is $32dBK^{-1}$ and the transponder bandwidth is 42MHz. Calculate the bit rate which can be accommodated and the EIRP required. **(6)**

(iii) For a satellite circuit the individual link carrier to noise spectral density ratios are: uplink 100dBHz; downlink 87dBHz. Calculate the combined C/N_0 ratio. **(2)**

13.(a)(i) Bring out the purpose of Digital Modulation in Satellite links. Explain in detail the BPSK modulation technique with a suitable block diagram. **(8)**

(ii) A ku-band Satellite uplink has a carrier frequency of 14.5 MHz and carries a symbol stream at Rs=16Msps. The transmitter and receiver have RRC filters with $\alpha = 0.25$. What is bandwidth occupied by RF signal, and what is the frequency Range of the transmitted RF signal? **(4)**

(iii) Explain in brief the working of Turbo codes. **(4)**

OR

13.(b)(i) What are the TDM standards for satellite communication? Explain with a suitable diagram. **(8)**

(ii) A satellite link achieves a C/N receiver in the receiver under clear air conditions of 14.0 db. (14.0dB= power ratio of 25). The receiver has a RRC filter with a noise bandwidth of 1.0 MHz and a roll off factor of 0.3 with Ideal correlation detection BPSK and QPSK demodulators. What are the bit rate, Symbol rate, occupied (absolute) bandwidth of the link and BER when the link is operated.

1. with BPSK modulation
2. with QPSK modulation

If rain attenuation on the link causes the received signal to be attenuated by 3db. What are the new BER values for BPSK and QPSK modulations? Assume that real RRC filters are used. **(8)**

14.(a) Explain the TDMA burst and frame structure of satellite system. Draw the necessary diagrams. **(16)**

OR

14.(b)(i) Explain the spread spectrum techniques used in a CDMA design? **(8)**

(ii) Compare the CDMA system with TDMA and FDMA in terms of its capacity. **(4)**

3. A DS-SS CDMA system has a number of earth stations sharing a single 54 MHz ka-band transponder. Each station has a different 1023 bit PN sequence which is used to spread the traffic bits into a bandwidth of 45 MHz. The transmitters and receivers use RRC filters with α=0.5 and the chip rate is 30 Mcps. Determine the number of earth stations that can be supported by the CDMA system if the correlated output S/N=12 db. **(4)**

15.(a) What is meant by DTH? What are the design issues to be considered for launching? DTH systems? **(16)**

OR

15.(b)(i) Give an overview of the VSAT systems and Explain the various network Architectures of a VSAT system. **(12)**

(ii) What are the scientific and military applications of a satellite? **(4)**
