Model Question
Eighth Semester BTech Degree Examination (2013 Scheme)

13.806.6 SATELLITE COMMUNICATIONS (T) (Elective VI)

Time 3 hrs Max marks 100

Part A

Answer all questions (10 x 2 marks)

1. A satellite is orbiting Earth in a uniform circular orbit at a height of 630 km from the surface of Earth. Assuming the radius of Earth and its mass to be 6370 km and 5.98×10^{24} kg respectively, determine the velocity of the satellite (Take the gravitational constant G = $6.67 \times 10^{-11} Nm^2/kg^2$).
2. Write the need for station keeping in satellites
3. Compare advantages of three axis body stabilisation to spin stabilisation for satellites
4. Draw block diagram of a transponder
5. In a point-to-point satellite communication system, the carrier signal strength at the satellite as received over the uplink is 40 dB more than the strength of the interference signal from an interfering Earth station. Also, the strength of the signal power received at the desired Earth station over the downlink is 35 dB more than the strength of the interference signal power due to an interfering satellite. Determine the total carrier-to-interference ratio of the satellite link.
6. Write advantages and disadvantages of FDMA
7. Three message signals m1(t), m2(t) and m3(t) with bandwidths of 2.4 kHz, 3.2 kHz and 3.4kHz respectively are to be transmitted over a common channel in a time multiplexed manner. Determine the minimum sampling rate for each of the three signals if a uniform sampling rate is to be chosen. Also determine the sampling interval of the composite signal.
8. Write any two applications of Weather Forecasting Satellite
9. Write basic principle of operation of the GPS
10. Draw block diagram of a DBS receiver

Part B

Answer one question from each module (4 x 20 marks)

Module 1

11. a) Explain Keplers laws of planetary motion (10 marks)
    b) The horizontal velocity with which a satellite is injected into space by launch vehicle has a direct bearing on the satellite trajectory. Explain (10 marks)
12. a) Explain Geostationary satellite launch sequence (10 marks)
    b) Explain commonly employed techniques for satellite attitude control (10 marks)

Module 2

13 a) Derive expression for overall Noise Figure and Noise Temperature of Stages in cascade (10 marks)
b) A 12 GHz receiver consists of an RF stage with gain G1 =30 dB and noise temperature T1 =20 K, a down converter with gain G2 = 10 dB and noise temperature T2 = 360 K and an IF amplifier stage with gain G3 = 15 dB and noise temperature T3 = 1000 K. Calculate the effective noise temperature and noise figure of the system. Take the reference temperature to be 290 K. (10 marks)

14. A certain 6/4 GHz satellite uplink has the following data on various gains and losses:

1. Earth station EIRP = 80 dBW
2. Earth station satellite distance = 35 780 km
3. Attenuation due to atmospheric factors = 2 dB
4. Satellite antenna's aperture efficiency = 0.8
5. Satellite antenna's aperture area = 0.5m^2
6. Satellite receiver's effective noise temperature = 190 K
7. Satellite receiver's bandwidth = 20 MHz

Determine the link margin for a satisfactory quality of service if the threshold value of the received carrier-to-noise ratio is 25 dB. (20 marks)

Module 3

15 a) Explain typical format of TDMA burst structure (10 marks)

b) Find average probability of missing the unique word in TDMA frame in the shift register of the correlator, if E is maximum number of errors allowed in the UW of length N bits, I be the actual number of errors in the UW as received and p the average probability of error in transmission (10 marks)

16 a) Explain with block diagram, working of frequency hopping CDMA transmitter and receiver (10 marks)

b) With block diagram explain MCPC/FDM/FM/FDMA system (10 marks)

Module 4

17 a) Explain functioning of a generalized Earth station with block schematic (10 marks)

b) Explain earth station design considerations (10 marks)

18 a) With block diagram explain arrangement of test set-up for measurement of receiver G/T (10 marks)

b) With block diagram explain working of typical VSAT network (10 marks)