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. What is meant by diffraction and scintillation in radio wave propagation? Explain their effect in satellite communication. **(08 Marks)**

   b. How is it possible to reduce interference due to ground reflected waves in earth stations? **(06 Marks)**

   c. Calculate the free space loss between a satellite and an earth station if EM wave is assumed to be exactly in the point to point pencil beam communication and travels a distance of 40,000 km. The carrier frequency is 64 Hz. **(06 Marks)**

2 a. What are the electrical properties of ionosphere? Why polarization rotation occurs in ionosphere? What is its effect at the receiver? **(08 Marks)**

   b. What is tropospheric scattering, how does it effect satellite communication? **(04 Marks)**

   c. What are window frequencies? Why microwave frequencies are preferred in satellite communication? **(08 Marks)**

3 a. What are Kepler's laws of orbiting body that orbits around a primary body only due to influence of mutual gravitational force between these bodies? Derive an equation to show that Kepler's laws are true for a satellite in geosynchronous orbit. **(08 Marks)**

   b. A satellite is orbiting in space around the earth at a radius of 42120 km. Find the velocity and time of orbit. Assume the gravitational coefficient of earth is 3,98,600.5 km^3/sec^2. Is it near geosynchronous? **(08 Marks)**

   c. What do you mean by near-geostationary satellites? **(04 Marks)**

4 a. Define the following:
      i) Perigee   ii) Sun synchronous orbit   iii) Satellite eclipse
      iv) Sidral day   v) Sun outage **(10 Marks)**

   b. Show that a geostationary satellite cannot cover areas around the poles of the earth. **(06 Marks)**

   c. What do you mean by antenna look angle? Explain. **(04 Marks)**

PART – B

5 a. What are the different losses that a propagating wave suffers while traveling from earth station to satellite and vice-versa? Explain, which of these is prominent and why? **(08 Marks)**

   b. It is proposed to setup a link between earth stations 2500 km apart through a geo-stationary satellite. The slant range of first station to satellite is 38000 km and that of second earth station to satellite is 40,000 km. The average atmospheric losses are 5 dB for 99.9% of the time. If the rain attenuation path is 18 km and loss at 14/12 GHz link is 0.5 dB/km, calculate the EIRP required for a minimum power of 12 pw at the receiver. The satellite has an overall gain of 120 dB. The antenna used at the receiver is a 5 m dish with 75% efficiency.
      Draw the link setup indicating power at each input and at output in dB, if transmitting antenna gain is 62dB. **(12 Marks)**

6 a. Mention the various sources of noise in satellite systems and explain each one of them briefly. **(08 Marks)**

b. Calculate the noise power and carrier to noise ratio in the receiving system shown in Fig.Q6(b). The received noise power density 'No' is –213.6 W/Hz and carrier power 'C' is –82 dBW. The system has an IF amplifier whose 3 dB bandwidth is 40 MHz. Is the receiver gain sufficient? **(08 Marks)**
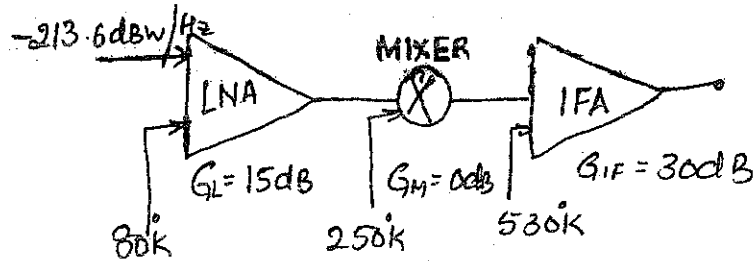

Fig.Q6(b)

Given : K → Boltzman constant = -228.6 dBJ/°K

c. What is an absorptive network? How noise is calculated in such a network? **(04 Marks)**

7 a. What is meant by the terms attitude control and station keeping? Explain how these are achieved. **(08 Marks)**

b. How T T and C helps in keeping the satellite in orbit during launch and during operation from its parking place? Give a typical T T and C arrangement. **(06 Marks)**

c. Explain the following:
   i) Input demultiplexer of a satellite
   ii) Back-off
   iii) Foot print **(06 Marks)**

8 a. Compare the performance of FDMA and TDMA, with respect to synchronization, power requirement and interference. **(06 Marks)**

b. Calculate the frame efficiency and channel capacity of a satellite transport used for voice in 8 bit PCM / TDM / BPSK / TDMA mode, if :
Total frame period is 5 msec and frame length is equivalent to 140000 symbols. There are 18 traffic bursts in the TDMA frame with one reference after every six bursts. The guard intervals between reference and pre-amble are equivalent to 50 symbols and between frames 120 symbols. The preamble is made up of 256 symbols and reference 264 symbols including CDC. Guard time after every traffic burst is 128 symbols. **(06 Marks)**

c. Draw a CATV system that uses a satellite and explain its working. **(08 Marks)**

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