B.E / Extc / VIII / May 2006 / Satellite Comm.

P4/RT-Ex-06-77

Con. 2439-06. (REVISED COURSE) TV-8904

(3 Hours) [Total Marks : 100

N.B. (1) Question No 1 is compulsory
(2) Solve four questions from Questions Nos. 2 to 7.
(3) Draw neat sketches / diagrams, wherever necessary.
(4) Make suitable assumptions, wherever necessary and justify it.
(5) Figures to the right indicate full marks.

1. (a) Define the following :– 5
   (i) Footprint
   (ii) Prograde and Retrograde Orbits
   (iii) Cross-polarisation discrimination
   (iv) EIRP
   (v) Geocentric-equatorial co-ordinate system.

   (b) In a TDMA network, the reference burst and preamble each requires 560 bits and nominal guard time between bursts is equivalent to 120 bits. Given that there are eight traffic bursts and one reference burst per frame and total frame length is equivalent to 40,800 bits, calculate frame efficiency. 5

   (c) What do you understand by Geosynchronous satellites ? What are the advantages and disadvantages of Geosynchronous satellites ? 5

   (d) The receiving installation having (G/T) of 20.6 dB/k is used as a ground terminal to receive a signal from a satellite at a distance of 38,000 kms. The satellite has a transmitter power of 50 watts and an antenna gain of 30 dBi. Assume losses between the satellite transmitter and its antenna are negligeble. The frequency is 12 GHz. Calculate the carrier to noise ratio at the receiver for a bandwidth of 1 MHz. 5

2. (a) A satellite is orbiting in a geosynchronous orbit of radius 41,500 kms. Find the velocity and time of orbit. What will be change in velocity if the radius reduces to 36,000 km. (Take μ = Earth's Geocentric Gravitational constant = 3.98×10^{14} M^3/S^2) 6

   (b) Explain in detail various types of antenna systems used in satellite earth stations. 8

   (c) Explain what is meant by orthogonal polarisation and the importance of this in satellite communication. 6

3. (a) Explain what is meant by satellite attitude and briefly describe two forms of attitude control. Support your answer with neat sketches. 8

   (b) Explain in detail single conversion and double conversion satellite transponder. 8

   (c) Explain in brief the significance of solar eclipse in satellite communication and its effect on communication satellites. 4

4. (a) What is meant by pre-assignment and demand assignment multiple access techniques in satellite communication ? Discuss in detail how demand assignment may be implemented in a TDMA network. 8

   (b) (A) The transponder bandwidth for CTS satellite system is 36 MHz and free space loss in uplink is 207.3 dB other uplink parameters are :– 12
   Atmospheric attenuation = 0.18 dB
   Ground station transmitter power output = 17.86 watts
   Feeder loss = 0.15 dB
   Ground station antenna gain = 59.69 dB
   Satellite antenna gain = 38 dB
   Satellite system temperature = 1349 K.

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Calculate : (i) Satellite received carrier level in dBW
(ii) Satellite receiver noise power
(iii) C/N ratio in dB at satellite input.

(B) The transponder in CTS Satellite has a gain at 120.7 dB and is operated at the power input obtianed in {A](i)} above. Downlink parameters are :-
Satellite antenna feeder loss = 0.75 dB
Satellite antenna gain = 36.7 dB
Ground station antenna gain = 41.2 dB
Antenna pointing loss = 0.2 dB
Ground Station receiver system temperature = 1020 K
Free space loss = 205.9 dB
Atmospheric attenuation = 0.14 dB.

Calculate : (i) Satellite EIRP
(ii) Ground station received power in dBW
(iii) Input noise power at ground station receiver
(iv) Ground station (C/N) ratio.

5. (a) Draw a block diagram for transmit receive type earth station and explain each block in brief. 10

(b) Describe the TT & C facilities of a satellite communication system. Explain why an omnidirectional antenna must be used a board a satellite for telemetry and command during the launch phase. How is the satellite powered during this phase ? 10

6. (a) What makes BPSK/QPSK the most widely used digital modulation techniques used in satellite communication ? Which are the other techniques used in Satellite communication ? 10

(b) A Satellite transponder has a bandwidth of 36 MHz and a saturation EIRP of 27 dBW. The earth station receiver has a G/T ratio of 30 dB/K, and the total link losses are 196 dB. The transponder is accessed by FDMA carriers each of 3 MHz bandwidth, and 6-dB output back-off is employed. Calculate the down link carrier-to-noise ratio for single-carrier operation and the number of carriers which can be accommodated in the FDMA system. The carrier to noise ratio determined for single-carrier operation may be taken as the reference value and it may be assumed that the uplink noise and intermodulation noise are negligible. 6

(c) Explain in brief how depolarisation is caused by rain. 4

7. Write short notes on the following (any **four**) :- 20
(a) Code Division Multiple Access
(b) Orbital Perturbations
(c) Various types of Satellite orbits and their advantages and disadvantages
(d) Intermodulation Distortion and back-off in Satellite coomunication
(e) SPADE system
(f) Feed system in earth stations.