B·E / VIII / (Rev.) / EXTC / Nov '05 / satellite comm. /

k·t·EXAM.

Con. 4818-05. (REVISED COURSE) PR-5555

(3 Hours) [Total Marks : 100

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

1. (a) Define the following terms : 5
   (i) True anamoly
   (ii) Jamming Margin
   (iii) Antenna Bandwidth
   (iv) Doppler Shift
   (v) Equinox.

   (b) A PN sequence is generated using a feedback register of length M = 4. The chip rate is 107 chips per second. Find the following parameters :—
   (i) PN sequence length 2
   (ii) Chip duration of PN sequence 2
   (iii) PN sequence period. 1

   (c) Mention atleast ten points of comparision between Low attitude, Medium altitude and High altitude satellites. 10

2. (a) Derive the expression for satellite look angle coverage angle, and slant range. 12
   (b) Explain with frame structure the Demand Assignment TDMA scheme. 8

3. (a) What is telemetry, tracking and command subsystem ? Explain its functioning with block diagram. What kind of antennas are used for tracking and command signal transmission during transfer orbit and on orbit ? 10
   (b) Draw a block diagram for transmit-receive type earth station. Explain each block in brief. 10

4. (a) Differentiate between the following :—
   (i) Centralised Control System and Distributed Control System in DA-FDMA. 5
   (ii) FH-CDMA and DS-CDMA. 5
   (b) List the different digital modulation techniques used in satellite communication, why BPSK or QPSK are the most widely used schems ? Give suitable reasons. 10

5. It is decided to establish a satellite link (using transperent satellite) between two earth stations. The data are as follows :—
   (a) Uplink frequency, f_u = 14 GHz
   (b) Downlink frequency, f_D = 12 GHz
   (c) Downlink path loss, L_D = 206 dB.

   For Satellite :
   (i) Power flux density required to saturate the satellite channel amplifier, $(\phi_{sat,\ nom})_{SL} = -90$ dBW/m²
   (ii) Gain on the axis of the receiving antenna, $G_{R_{max}} = 30$ dB
   (iii) Figure of Merit $(G/T)_{SL} = 3{\cdot}4$ dBK^{-1}
   (iv) Channel amplifier characteristic (single carrier operation) modelled by—
   $$OBO(dB) = IBO(dB) + 6 - 6 \exp [\ IBO(dB)/6\ ]$$
   (v) Effective isotropic radiated power at saturation, $[\ EIRP_{sat}\ ]_{SL}$ = 50 dBW
   (vi) Gain on the axis of the transmitting antenna, $G_{Tmax} = 40$ dB$_i$.

   The transmit and receive earth station are located at the centre of converage. The following losses are considered :
   (i) T_X and $R_X - L_{FRX}$ and L_{FTX} = 0dB
   (ii) Polarisation mismatch, L_{POL} = 0dB
   (iii) Depointing losses, $L_R = L_T$ = 0dB (ESat boresight)
   (iv) Figure of Merit $(G/T)_{ES} = 25$ dBK^{-1}

   Assume that there is no interference, calculate :
   (i) Satellite repeater gain at saturation 3
   (ii) C/No for uplink and downlink and the overall link when the repeater operates at saturation. 5
   (iii) Input back-off and output back-off to achieve $(C/No)_T = 80$ dBHz and corresponding values of $(C/No)_{uplink}$ and $(C/No)_{downlink}$ $\left\{\begin{array}{l} IBO = -16{\cdot}4\ dB \\ OBO = -10{\cdot}8\ dB \end{array}\right\}$ 4
   (iv) $(C/No)_T$ under rain conditions causing an attenuation of 6 dB on the uplink. 4
   (v) $(C/No)_T$ under rain conditions causing an attenuation of 6 dB on downlink with a reduction of 2 dB in figure of merit of Earth Station (ES) due to increase in antenna noise temperature (IBO = –13 dB, OBO = –7·7 dB). 4

6. (a) Determine the limits of visibility of earth station situated at main sea level, at a latitude of 48·42°N and a longitude 89·26°W. Assume a minimum angle of elevation of 5°. 8
   (b) Describe the symmetrical, offset and the Cassergrain mounting of a parabolic reflector. 8
   (c) Discuss the effects of earths oblateness on the orbital incilination of a geosynchronous satellite. 4

7. Write short notes on (any **four**) :— 20
   (a) Single conversion and Double ... der (d) SP...