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10EC662

Sixth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Satellite Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Describe briefly the main advantages offered by satellite communications. Explain what is meant by a distance insensitive communication system. **(06 Marks)**

b. Explain the various frequency bands used and various services provided by a satellite. **(08 Marks)**

c. Describe briefly the development of INTELSAT starting from the 1960s through the present. **(06 Marks)**

2 a. Explain briefly the orbital parameters required to determine a satellite orbit. **(08 Marks)**

b. The two satellites are moving in different elliptical orbits with the same perigee but different apogee distances. The semimajor axes of the two orbits are 16000 km and 24000 km. Determine the orbital period of satellite 2 if the orbital period of satellite 1 is 600 min. **(04 Marks)**

c. An earth station is located at latitude 30°S and longitude 130°E. calculate the antenna-look angles for satellite at 156°E. Assume radius of earth 6371 km and a_{GSo} = 42,164 km. **(08 Marks)**

3 a. Explain what are rain rate, specific attenuation and effective path length in connection to rain attenuation? **(06 Marks)**

b. For an uplink the required [C/N] ratio is 20 dB. The operating frequency is 30 GHz, and the bandwidth is 72 MHz. The satellite [G/T] is 14.5 dBK^{-1}. Assuming operation with 11 dB input BO (i) Calculate the saturation flux density [RFL] arel dB (ii) The total losses amount to 218 dB. Calculate the earth station [EIRP] required. **(08 Marks)**

c. What is the system noise temperature? Derive the expression for equivalent noise temperature. **(06 Marks)**

4 a. Explain briefly the Telemetry, Telecommand and Tracking control (TTC-m) monitoring system of a communication satellite, with a block diagram. **(08 Marks)**

b. What is attitude control as applicable to satellites? Explain with the help of a diagram, spin stabilization of satellites. **(08 Marks)**

c. Explain: (i) Satellite transponder (ii) Frequency reuse. **(04 Marks)**

PART – B

5 a. With the aid of a block schematic, describe the functioning of a transmit-receive earth station used for telephone traffic. **(06 Marks)**

b. Explain what is meant by the term redundant earth station. **(04 Marks)**

c. (i) The desired carrier [EIRP] from a satellite is 34 dBW, and the ground station receiving antenna gain is 44 dB in the desired direction and 24.47 dB toward the interfering satellite. The interfering satellite also radiates an [EIRP] of 34 dBW. The polarization discrimination is 4 dB. Determine the carrier-to-interference ratio at the ground receiving antenna.

(ii) Station A transmits at 24 dBW with an antenna gain of 54 dB, and station C transmits at 30 dBW. The off-axis gain in the S_1 direction is 24.47 dB, and the polarization discrimination is 4 dB. Calculate the [C/I] ratio on the uplink.

(iii) Find the overall ratio $[C/I]_{ant}$, using the uplink and downlink values of [C/I] calculated. **(10 Marks)**

6 a. Explain the spade system, with a neat diagram. **(07 Marks)**

b. With a neat diagram, explain frame and burst formats for a TDMA system. **(07 Marks)**

c. A 14 GHz uplink operates with transmission losses and margins totaling 212 dB and a satellite [G/T] = 10 dB/K. The required uplink $[E_b/N_o]$ is 12 dB. (i) Assuming FDMA operation and an earth-station uplink antenna gain of 46 dB, calculate the earth-station transmitter power needed for transmission of a T_1 baseband signal. (ii) If the downlink transmission rate is fixed at 74 dBb/s, calculate the uplink power increase required for TDMA operation. **(06 Marks)**

7 a. Describe the operation of a typical VSAT system. State briefly where VSAT system found widest application. **(10 Marks)**

b. With respect to direct broadcast satellite services, explain (i) Orbital spacing (ii) Power rating and number of transponders (iii) Frequency of operation. **(10 Marks)**

8 a. Explain the global positioning system, in detail. **(10 Marks)**

b. Describe the main features of the Irridium system and comment briefly on how is this different from the orbcomm system. **(10 Marks)**

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