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Sixth Semester B.E. Degree Examination, Dec.2014/Jan. 2015
Satellite Communication

Time: 3 hrs.

Max. Marks:100

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

PART – A

- 1 a. Describe the various services provided by the satellite with the frequency band designations. (06 Marks)
- b. Define the terms : i) Ascending node ii) Prograde orbit iii) mean anomaly iv) true anomaly. (04 Marks)
- c. Determine the rate of regression of the nodes and the rate of rotation of the line of apsides for the satellite parameters, mean motion 14.23/day inclination 98.63, eccentricity 00.00115, argument of perigee 113.55°, right ascension of the ascending node 251.53° and constant $k_1 = 66063.1704 \text{ km}^3/\text{s}^2$. Find the new values of argument of perigee and right ascension of the ascending node one period after epoch. Constant $\mu = 3.986005 \times 10^{14} \text{ m}^3/\text{s}^2$. (10 Marks)
- 2 a. What is sidereal time and mean solar time? Give the relation between them. (05 Marks)
- b. What is sun synchronous orbit? How it is achieved. (07 Marks)
- c. A geostationary satellite is located at 90°W. The average radius of the earth is 6371 km and radius of the circular orbit is 42164 km. The earth station antenna is at latitude 35°N and longitude 100°W. Determine the azimuth, elevation and range of the satellite. (08 Marks)
- 3 a. Derive the noise temperature for an absorptive network. Show that at room temperature the noise factor of a lossy network is equal to the power loss. (06 Marks)
- b. A multiple carrier satellite circuit operates in the 6/4 GHz band with the following characteristics ; uplink saturation flux density $-67.5 \text{ dBW}/\text{m}^2$; input Bo 11 dB; free space loss 196.7 dB, earth station G/T is 40.7 dBK^{-1} . Constant $k = 1.38 \times 10^{-23} \text{ J/K}$. The other losses may be ignored. Calculate the combined uplink and down link C/N ratio. (08 Marks)
- c. Find the rain attenuation for a frequency 12 GHz signal transmission from the earth station altitude 600 m and the antenna elevation is 50°. The rain height is 1.5 km and horizontal polarization is used. The rain rate $R_{0.01} = 15 \text{ mm/h}$ and attenuation coefficients $a_h = 0.0188$, $a_v = 1.217$. (06 Marks)
- 4 a. What are the functions of TT and C subsystem? Explain with a neat block diagram, of satellite control system. (07 Marks)
- b. With a neat sketch, explain the operation of traveling wave tube amplifier. (08 Marks)
- c. Describe briefly how the beam shaping of a satellite antenna radiation pattern is achieved. (05 Marks)

PART – B

- 5 a. Describe the master antenna TV system and the community antenna TV system. (08 Marks)
- b. Explain the transit –receive earth station with a detected block diagram. (07 Marks)
- c. A geostationary satellite employs a 3.5 m parabolic antenna at a frequency of 12 GHz. Find the -3 dB beam width and the spot diameter on the equator. (05 Marks)

- 6 a. Explain the operation of a spade system along with the channeling scheme. (06 Marks)
- b. Describe the operating principle of a TDMA network. How the transmission bit rate is related to the input bit rate. (07 Marks)
- c. A 14 GHz uplink operates with transmission losses 212 dB and a satellite $[G/R] = 10$ dB. The required uplink $[E_b/N_0]$ is 12 dB.
- i) Assuming FDMA operation and on earth station uplink antenna gain of 46 dB, find the earth station transmitter power needed for T, baseband signal rate 1.544 Mb/s. Boltzmann's constant $k = 1.38 \times 10^{-23}$ J/k
- ii) If the downlink transmission rate is 74 dB/s find the uplink power increase required for TDMA (07 Marks)
- 7 a. Explain the satellite switched TDMA with the different modes of connectivity for three beams. How many switching modes are required for full inter connectivity? (08 Marks)
- b. Explain the DSS frequency plan for region 2. (06 Marks)
- c. How the bit rates for digital television are determined? Compute the uncompressed bit rate for SDTV format having resolution 640×480 pixels at 30 frames per second out 16 bit per pixel. (06 Marks)
- 8 a. Describe the operation of a typical VSAT system along with its application. (08 Marks)
- b. Explain the GPS system for position determination. (05 Marks)
- c. What is down to dusk orbit? Why the Ratarsat follows such an orbit? What are the application or Radarsat. (07 Marks)
