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06EC662

Sixth Semester B.E. Degree Examination, December 2012

Satellite Communications

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State and explain Kepler's three laws of planetary motions. **(06 Marks)**

b. With the help of neat diagram, explain Keplerian orbital elements. **(08 Marks)**

c. Determine the rate of regression of the nodes and the rate of rotation of the line of apsides for LEO satellite of semimajor axis 7192.335 km, inclination is 98.6328°, eccentricity 0.0011501, mean motion is 14.23304826 day^{-1}, ω_o = 113.5534°, Ω_o = 251.5324° also find new value for ω and Ω one period after epoch. **(06 Marks)**

2 a. Give the conditions for geostationary orbit. Determine the angle of tilt required for polar mount antenna used with an earth station at latitude 49° N, assume earth mean radius 6371 km. **(08 Marks)**

b. Define saturation flux density. Derive the expression for saturation flux density. **(06 Marks)**

c. A multiple carrier satellite circuit operates in 14/12 GHz band with following characteristics:
Uplink: Saturation flux density -67.5 dB W/m^2
Input Backoff 11 dB, satellite G/T – 11.6 dBK^{-1}
Down link: Satellite saturation EIRP 26.6 dBW, output BO 6 dB, FSL 196.7 dB, earth station G/T 40.7 dBK^{-1}, calculate carrier to noise density ratio for both links and combined value. **(06 Marks)**

3 a. For the system given in Fig.Q3(a)(i) and (ii), the receiver noise figure is 12 dB, cable loss 5 dB, LNA gain 50 dB and it's noise temperature 150 K, antenna noise temperature 35 K, calculate noise temperature referred to the input. Conclude the result. **(07 Marks)**

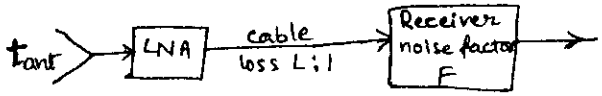

Fig.Q3(a)(i)

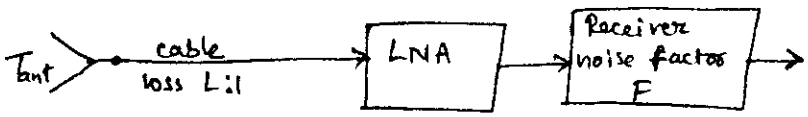

Fig.Q3(a)(ii)

b. Calculate rain attenuation for a frequency of 18 GHz for circular polarization. The rain height 2 km, a rain rate of 10 mm/h is exceeded for 0.001 percent of the year. The earth station altitude 600 m and antenna elevation angle is 35°. (a_n = 0.0751, q = 0.0691, b_h = 1.099, b_v = 1.065) **(08 Marks)**

c. Explain earth eclipse of satellite and sun transit outage. **(05 Marks)**

4 a. With the help of neat diagram, explain two forms of attitude control. **(12 Marks)**

b. Explain satellite wide band receiver and input demultiplexer. **(08 Marks)**

PART – B

5 a. Explain indoor and outdoor unit of direct broadcasting satellite TV reception with block diagram. **(10 Marks)**

b. An FM/TV carrier is specified as having a modulation index of 2.571 and a top modulating frequency of 4.2 MHz. Calculate the protection ratio required to give a quality impairment factor of (i) 4.2 and (ii) 4.5. **(04 Marks)**

c. Explain preassigned FDMA. **(06 Marks)**

6 a. Explain unique word detection. Obtain equation for miss probability and false detection probability. **(12 Marks)**

b. Explain on Board Signal processing for FDMA/TDM operation. **(08 Marks)**

7 a. Explain global positioning satellite system in detail. **(08 Marks)**

b. Describe the operation of typical VSAT system. **(06 Marks)**

c. Explain iridium satellite system. **(06 Marks)**

8 a. Explain the services provided by the satellites. **(08 Marks)**

b. Explain the following:

i) Spade system

ii) Transmit-Receive earth stations. **(12 Marks)**

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