USN ⬜⬜⬜⬜⬜⬜⬜⬜⬜⬜ **10EC662**

Sixth Semester B.E. Degree Examination, June/July 2017

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. Explain the services provided by a satellite. **(06 Marks)**
   b. State and explain Kepler's three laws of planetary motion and give necessary equations. **(08 Marks)**
   c. Define the terms:
      i) Retrograde orbit and prograde orbit
      ii) Mean anomaly and true anomaly
      iii) Ascending and descending node. **(06 Marks)**

2 a. Calculate the semimajor axis for the satellite parameter NN $= 14.23304826$ day^{-1} and explain the phenomenon Earth eclipse of satellite. Assume $\mu = 3.986005 \times 10^{14}$ m^3/s^2. **(08 Marks)**
   b. Calculate the apogee and perigee heights for the orbital parameters $e = 0.0011501$ and $a = 7192.335$ km. Assume a mean earth radius of 6371 km. **(03 Marks)**
   c. Define Sidereal day and Solar day. **(02 Marks)**
   d. A geostationary satellite is located at 90°W. Calculate the azimuth angle for an earth station antenna at latitude 35°N and longitude 100°W. Also find the range and antenna elevation angle. Assume radius of orbit $a_{450} = 42164$ km and the average radius of earth $R = 6371$ km. **(07 Marks)**

3 a. A QPSK signal is transmitted by a satellite. Raised-Cosine filtering is used, for which the roll off factor is 0.2 and BER of 10^{-5} with [E_b/N_0] $= 9.6$ dB is required. For the satellite downlink, the losses amount to 200 dB the receiving earth station G/T ratio is 32 dBK^{-1}, and the transponder bandwidth is 36 MHz. Calculate: i) the bit rate which can be accommodated, and ii) the EIRP required. Assume K $= -228.6$ with losses 200 in dB. **(06 Marks)**
   b. Explain carrier to noise ratio of a satellite link. **(07 Marks)**
   c. Show that the rain attenuation in decibels is given by $A_p = aR_p^b L_s r_p$ dB. **(07 Marks)**

4 a. Explain momentum wheel stabilization of satellite. **(06 Marks)**
   b. Explain how station keeping is done in satellites. **(06 Marks)**
   c. What is transponder of satellite and with a neat diagram, explain wideband receiver of satellite transponder. **(08 Marks)**

PART – B

5 a. With the help of a block diagram, explain transmit-receive earth station. **(08 Marks)**
   b. Describe briefly the modes of interference that can occur in a satellite communication system. **(06 Marks)**
   c. What is master antenna TV system? With the help of a diagram, describe an arrangement for MATV system. **(06 Marks)**

6   a. 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 T1 baseband signal.

        ii) If the down link transmission rate is fixed at 74 dBb/s, calculate the uplink power increase required for TDMA operation. For T1 bit rate is 1.544 Mb/s or $[R_b]$ = 62 dBb/s K = –228.6.   (06 Marks)

   b. Explain the following methods in demand-assigned FDMA:

        i) Polling method

        ii) Centrally controlled random access.   (04 Marks)

   c. Explain on-board signal processing for FDMA/TDM operation.   (10 Marks)

7   a. Calculate the bit rate that can be carried in the 24 MHz channel using QPSK, allowing a roll off factor of 0.2.   (04 Marks)

   b. With respect to direct broadcast satellite service, explain the following:

        i) Orbital spacing

        ii) Power rating of transponder

        iii) Frequencies and polarization   (08 Marks)

   c. Explain the following:

        i) Transponder capacity

        ii) Bit rate for digital TV   (08 Marks)

8   a. Explain a very small aperture terminal system.   (08 Marks)

   b. Write short note on:

        i) Radarsat

        ii) Global positioning system   (12 Marks)

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