AMIETE – ET (OLD SCHEME)

Code: AE22   **Subject: SATELLITE & SPACE COMMUNICATION**
Time: 3 Hours   **Max. Marks: 100**

JUNE 2011

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1   **Choose the correct or the best alternative in the following:**   **(2×10)**

   a.   In which of the following satellite system Doppler shift is negligible.

      (A) Geostationary satellite   **(B)** Near earth orbit satellite
      (C) Domestic satellite system   **(D)** Geosynchronous satellite

   b. The satellite that is used for weather forecast application

      (A) GORIZOT   **(B)** TIROS-N
      (C) COSMSAT   **(D)** SPOT

   c. The location of geostationary satellite is always given in terms of

      (A) A certain longitude   **(B)** certain Latitude
      (C) longitude and latitude   **(D)** distance from the earth surface

   d.   The minimum numbers of geostationary satellite needed for uninterrupted global coverage is

      (A) 3   **(B)** 4
      (C) 1   **(D)** 2

   e. When the orbit eccentricity (e) equal to zero, the orbit is

      (A) a parabola   **(B)** a hyperbola
      (C) elliptical   **(D)** circular

   f. The satellite in which the antenna are mounted on a de–spun plate form is the

      (A) geostationary satellite   **(B)** sun synchronous satellite
      (C) spin stabilised satellite   **(D)** 3-axis body stabilised satellite

g. The multiple access technique that is particularly suitable for communication satellites with military applications is

(A) TDMA   (B) FDMA
(C) CDMA   (D) Random access

h. The purpose of Satellite repeater is

(A) Klystron   (B) Travelling Wave tube
(C) tunnel–diode amplifier   (D) Wave guide

i. The INSAT operate in

(A) S band   (B) C band
(C) Q band   (D) None of these

j. The duration of orbit of a satellite increases as the height of the satellite above the earth

(A) increases   (B) decreases
(C) is not effected   (D) first increases and then decreases

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Define the following terms:
(i) Look angles   (ii) Azimuth
(iii) Elevation   (iv) The sub satellite point.
Illustrate by a neat sketch, the geometry of the elevation angle calculation and briefly explain the equations for the calculation of the elevation angle. **(8)**

b. For an eccentric elliptical satellite orbit with an apogee and perigee points at a distance of 50,000 km and 8000 km respectively from the centre of earth. Determine the semi-major axis, semi-minor axis and the orbit eccentricity. **(8)**

Q.3 a. Calculate, for a frequency of 12 GHz and for circular polarization, the rain attenuation which is exceeded for 0.01 percent of time in any year, for a point rate of 10mm/h. The earth station altitude is 600m, and the antenna elevation angle is 50 degrees. The rain height is 3km. **(6)**

b. What are ionospheric scintillations? How are they caused? Comment on its effect on the radio wave. **(6)**

c. What are the Kepler's Three Laws for planetary motion? **(4)**

Q.4 a. What does the term EIRP stand for? Calculate the power received by the earth station using Flux density and link equation. **(10)**

b. A 4 GHZ receiver with the following gain and noise temperature

$T_{in} = 25K, T_{RF} = 50K, T_{IF} = 1000K, T_m = 500K, G_{RE} = 23dB,$
$G_{IF} = 30dB$

Calculate the system noise temperature assuming that the mixer has gain $G_m = 0dB$ Recalculate the system noise when the mixer has a 10–dB loss. How can be the noise temperature of the receiver be minimized when the mixer has the loss of 10 dB? **(6)**

Q.5 a. Write a brief note on pre-emphasis and de-emphasis. **(6)**

b. Explain how Quadrature Phase Shift Keyed (QPSK) signal can be represented by two Binary Phase Shift Keyed (BPSK) signal .Show that the band width required for QPSK signal is one-half that required for BPSK signal operating at the same data rate. **(10)**

Q.6 a. Which type of power amplifiers are widely used in transponders to provide the final output power? Explain it in detail. What are its main advantage and disadvantage? **(10)**

b. Write a short note on
(i) Moment Wheel Stabilization
(ii) Spin Satellite Stabilization **(6)**

Q.7 a. Briefly describe a TDMA frame. Illustrate by a simplified diagram, a TDMA frame for four transmitting earth stations and briefly explain. **(8)**

b. What is the expansion of 'SPADE' as used in satellite communication? With a neat illustration, explain the channelling scheme for the SPADE system. **(8)**

Q.8 a. What are convolution code and explain ½ rate convolution encoder? **(8)**

b. Write short note on
(i) Reed-Solomon code.
(ii) Linear block code. **(4×2)**

Q.9 a. With a sketch for illustration, briefly explain a mesh VSAT network. Furnish also the topology of the above network as viewed from the satellites perspective. **(8)**

b. What is CDMA? How are CDMA signals encoded? What do you mean by 'chips' used in a CDMA code and what is its function? **(8)**