

AMIETE – ET (OLD SCHEME)

Code: AE22
Time: 3 Hours

Subject: SATELLITE & SPACE COMMUNICATIONS
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.

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|-------------------------------|--------------------------------|
| (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

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

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

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|----------------------------|-------------------------------------|
| (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

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

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

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|----------------|-----------------|
| (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

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|-------------------------------|--------------------------------------|
| (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 operates 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 $\frac{1}{2}$ 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)