

Code: AE22

Subject: SATELLITE & SPACE COMMUNICATION

AMIETE – ET (OLD SCHEME)

Time: 3 Hours

JUNE 2012

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

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. The GEO satellite use frequency band extending from

- | | |
|-------------------|---------------------|
| (A) 3.2 to 50 GHz | (B) 3.2 to 50 MHz |
| (C) 1.2 to 20 GHz | (D) 1.2 to 2000 MHz |

b. The TELESTAR I was launched

- | | |
|---------------|---------------|
| (A) July 1952 | (B) July 1962 |
| (C) May 1968 | (D) May 1966 |

c. The first commercial satellite was launched in

- | | |
|----------|----------|
| (A) 1962 | (B) 1965 |
| (C) 1967 | (D) 1977 |

d. Weather satellite employs

- | | |
|---------------------|-------------------------------|
| (A) Polar satellite | (B) Geo –stationary satellite |
| (C) Both of these | (D) either of these |

e. The Cyclic codes are

- | | |
|--------------------|----------------------|
| (A) Linear codes | (B) Non-linear Codes |
| (C) Weighted codes | (D) FEC code |

f. A coding technique is highly efficient if

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|--|
| (A) Number of error detecting is high |
| (B) Number of error correcting is high |
| (C) Both of these |
| (D) None of these |

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- g. Satellite capacity depends upon
- (A) Weight that can be placed in orbit
 - (B) Panel area available for energy dissipation
 - (C) Transmitted power
 - (D) All the above
- h. The orbital velocity of a satellite
- (A) is directly proportional to its distance from the earth's surface
 - (B) is inversely proportional to square root of the distance from earth's center
 - (C) depends upon the trust with which it is launched
 - (D) it is continuously changing as the satellite revolves
- i. A payload that is invariably found on all communication satellite is the
- (A) Optical telescope
 - (B) VHRR
 - (C) Transponder
 - (D) Vidocon camera
- j. The multiple satellite access technique suitable only for digital transmission is the
- (A) Time Division Multiple Access
 - (B) Frequency Division Multiple Access
 - (C) Code Division Multiple Access
 - (D) Both (A) and (B)

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

- Q.2** a. What are Kepler's three laws of planetary motion? Give the mathematical formulation of Kepler's third-law of planetary motion. What do the terms perigee and apogee mean when used to describe the orbit of a satellite orbiting the earth? **(10)**
- b. A satellite is in an elliptical orbit with perigee of 1000 km and an apogee of 4000 km. Using a mean radius of 6378.14 km, find the period of the orbit in hours, minutes, seconds and the eccentricity of the orbit. **(6)**
- Q.3** a. Derive general link equation. Find the expression for C/N and G/T ratio. **(8)**
- b. In a satellite communication link the uplink carrier to noise ratio $(C/N)_u$ is 20 dB where as the downlink carrier to noise ratio $(C/N)_D$ is 25 dB. Find the link carrier to Noise ratio. **(8)**
- Q.4** a. What are ionospheric scintillations? How are they caused? Discuss its effect on the radio wave. **(8)**

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- b. What is the system noise temperature? Derive the expression for equivalent noise temperature. (8)
- Q.5** a. Explain analog FM/FDM television transmission through satellite. Write down the expression for S/N ratio calculation for satellite TV links. (8)
- b. Write a note on SCPC FM links. (4)
- c. A SCPC–FM satellite link has an RF channel bandwidth of 45 kHz and a base band maximum frequency of 3.4 kHz. De-emphasis provides a subjective improvement in base band S/N ratio of 7dB. Calculate the base band S/N ratio for the voice channel for a receiver C/N ratio of 13dB. If the FM demodulator has an FM threshold at 6 dB, what is the link margin for this system? (4)
- Q.6** a. What is meant by satellite attitude, and briefly describe two forms of attitude control? (6)
- b. With a sketch for illustration, briefly describe the channelling scheme for the twelve transponders of a typical C-band communications satellite. (10)
- Q.7** a. What is ‘Multiple Access’? Which multiple access technique is widely used as a method of sharing the bandwidth of satellite transponders? (6)
- b. Distinguish between pre-assigned and demand assigned traffic in relation to a satellite communication network. (3)
- c. What is the major difference between the cellular system and satellite system? Explain the frequency plan for 54 MHz transponder carrying 900 demand access channel? (7)
- Q.8** a. Describe how convolution coding is achieved. State some of the main advantages and disadvantages of this type of code compared with block codes. (8)
- b. What are error detection coding technique? Explain the linear and cyclic block code in detail. (8)
- Q.9** a. Explain VSAT and how it causes interference to other satellite devices. (8)
- b. Explain with a neat sketch satellite switching of three spot beams. (8)