|                           | Utech                                |
|---------------------------|--------------------------------------|
| Name:                     |                                      |
| Roll No.:                 | A Phonon (V Knowledge 2nd Copilises) |
| Invigilator's Signature : |                                      |

## CS / M.TECH (ECE) / SEM-2 / MCE-205-A / 2011 2011

### SATELLITE COMMUNICATION

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. 1 and any four questions from the rest.

Choose the correct alternatives for any ten of the following: 1.

 $10 \times 1 = 10$ 

- In a TDMA frame total frame length is 15 ms and i) overhead portion of the frame is 3 ms. Find the frame efficiency
  - a) 78 %

b) 80 %

60 %

- d) 70 %.
- Satellites are always launched towards ii)
  - a) east

b) west

c) north

- d) south.
- To make satellite visible from an earth station the iii) maximum angular separation between the earth station & the sub-satellite point is limited by
  - a)  $\gamma \leq \cos^{-1}(r_e/r_s)$  b)  $\gamma > \cos^{-1}(r_e/r_s)$  c)  $\gamma = \cos^{-1}(r_e/r_s)$  d)  $\gamma \geq \cos^{-1}(r_e/r_s)$ .

30078 (M.TECH)

[ Turn over

#### CS / M.TECH (ECE) / SEM-2 / MCE-205-A / 2011 Which system of satellite is known iv) satellites? a) LEO **MEO GEO** HEO. c) d) Earth station figure-of-merit is defined as v) 10 ln [ G/T ] 10 log [ G/T ] a) b) 10 log GT 20 log [ G/T ]. c) d) In the C band transponders downlink frequency is vi) about 6 GHz 4 GHz a) b) c) 11 GHz d) 14 GHz. Satellite capacity depends on vii) weight that can be placed in orbit a) b) panel area available for energy dissipation c) transmitter power all of these. d) viii) The satellite velocity is ...... at the perigee point. a) minimum b) maximum d) none of these. c) nil A satellite earth station antenna has a gain of 10<sup>6</sup> and a ix) noise temperature of 100° K. The earth station (G/T) in dB/Kelvin is 40 dB/K 80 dB/K a) b) c) indeterminate d) 20 bdB/K. In the *C* band transponders uplink frequency is about x) 8 GHz b) 4 GHz a) 6 GHz d) none of these. One of the following satellites is in a highly eccentric, xi) inclined orbit Molniya series a) b) Raduga Gorizont. Ekran d) c)

# CS / M.TECH (ECE) / SEM-2 / MCE-205 A 2011

d)

100 dB

250 dB.

xii) The range between a ground station and a satellite is 42000 km, the free space loss in dB at 6 GHz will be

200·4 dB

104·2 dB

c)

2.

3.

4.

5.

30078 (M.TECH)

| X111) | xiii) Retrograde orbits nave inclination angle  |                              |                   |                   |           |  |  |
|-------|---|------------------------------|-------------------|-------------------|-----------|--|--|
|       | a)  | 90 degree                    | b)                | > 90 degree       |           |  |  |
|       | c)  | zero degree                  | d)                | < 90 degree.      |           |  |  |
| xiv)  | Inter-modulation noise occurs in  |                              |                   |                   |           |  |  |
|       | a)  | receiving antenna            | b)                | mixer circuit     |           |  |  |
|       | c)  | transponder circuit          | d)                | solar panels.     |           |  |  |
| a)    | Discuss different types of satellites LEO, MEO, HEO and GEO.  |                              |                   |                   |           |  |  |
| b)    | n geostationary   | satellite                    |                   |                   |           |  |  |
| ,     | and geosynchronous satellite?   |                              |                   |                   |           |  |  |
| a)    | a) Derive general link equation. Find expressions for   |                              |                   |                   |           |  |  |
|       | and   | G/T ratio.                   |                   |                   | 4 + 2 + 2 |  |  |
| b)    | An earth station antenna has a diameter of 30 m, has  |                              |                   |                   |           |  |  |
|       |   | overall efficiency of 6      |                   |                   |           |  |  |
|       | signal at 4150 MHz. At this frequency, the system noise   |                              |                   |                   |           |  |  |
|       | temperature is 79 K, when the antenna points at the   |                              |                   |                   |           |  |  |
|       | satellite at an elevation angle of 28°. What is the earth   |                              |                   |                   |           |  |  |
|       | station G/T ratio under these conditions? If heavy rain   |                              |                   |                   |           |  |  |
|       |   | ses the sky temperatu        |                   |                   | =         |  |  |
|       | noise temperature rises to 88 K, what is the new $G/T$ value? What are your observations? $3 + 3 + 1$ |                              |                   |                   |           |  |  |
| Stat  |   | •                            |                   |                   | 3 + 3 + 1 |  |  |
| Stat  | e Kej   | pler's law of planetary i    | 1101101           | n and explain th  | em.       |  |  |
| A sa  | tellit  | e is in a 322 km high c      | ircula            | ar orbit. Determi | ine       |  |  |
| a)    | Orbital velocity in meters per second   |                              |                   |                   |           |  |  |
| b)    | The orbital period in minutes.  |                              |                   |                   |           |  |  |
| Give  | n av  | verage radius of the ea      | arth is           | s 6378 km and     | Kepler's  |  |  |
| cons  | stant   | has the value $3.986 \times$ | 10 <sup>5</sup> k | $m^3/s^2$ .       | 9 + 6     |  |  |
| a)    | Exp   | lain look angles and su      | ıb-sat            | tellite point.    | 6 + 1     |  |  |
| b)    | Der   | ive expression for eleva     | tion a            | ingle.            | 5         |  |  |

3

[ Turn over

## CS / M.TECH (ECE) / SEM-2 / MCE-205-A / 2011

What do you mean by slant range? Explain with the help of diagram. For a GEO satellite it is given a

3

- minimum elevation angle of 5°, the maximum slant range d = 41127 Km, c =  $3 \times 10^5$  Km/s.
- Find the satellite round trip delay.
- 6. a) Explain Transponder with the help of block diagram.

  How many types of transponders do you know?

  Illustrate them.

  3 + 4
  - b) What is an inter-modulation noise? Derive the expression for it. How can it be avoided? 2 + 5 + 1
- 7. Write short notes on any three of the following:  $3 \times 5$ 
  - a) GPS

c)

- b) VSAT
- c) MSAT
- d) Satellite subsystems
- e) Satellite launching techniques
- f) TDMA burst structure.

=========