



M.E DEGREE EXAMINATIONS: DEC 2015

(Regulation 2014)

Third Semester

COMMUNICATION SYSTEMS

P14COTE52: Satellite Communication

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Satellite-1 is in an elliptical orbit with a semi-major axis equal to a and satellite-2 is in another elliptical orbit having a semi-major axis equal to $4a$. The orbital period of satellite-2 is K₃-CO1
- a) Eight times that of satellite-1 b) Four times that of satellite-1
c) Twice that of satellite-1 d) One-eighth that of satellite-1
2. Match list I with list II and select the correct answer using the codes given below. K₂-CO1

List I	List II
A. Geostationary orbit	Lower launch cost
B. Low earth orbit	Medium propagation delay
C. Highly elliptical orbit	Large path loss
D. Medium earth orbit	Doppler effects highest

Codes: A B C D

- (a) 2 4 1 3
- (b) 3 4 1 2
- (c) 2 3 4 1
- (d) 4 1 2 3
3. Consider the following statements with respect to satellite subsystems. K₂-CO2
- In TWT, inter modulation distortion is increased by shifting the operating point closer to the linear portion of the curve.
 - Passive attitude control refers to the use of mechanisms which stabilize the satellite without putting a drain on the satellite's energy supplies.
 - The attitude and orbit control system keeps the satellite in the correct orbit and on station, and pointing in the correct direction.
 - Horn antennas are used at microwave frequencies when relatively narrow beams are required, as for global coverage.

Which of these statements are correct?

- a) 1,4
- b) 1,3
- c) 3,4
- d) 2,3

4. An isotropic radiator on a satellite platform is likely to be used K₂-CO2

- a) For providing Earth coverage
- b) During launch phase for TT&C operations
- c) For broadcast purpose
- d) As a feed for reflector type dish antenna

5. Calculate the effective noise temperature of rain for Sudbury (where rain attenuation exceeds 2dB for 0.1% of time) Assume $T_a=280K$. K₃-CO3

- a) 280K
- b) 206K
- c) 52K
- d) 103K

6. Consider the following steps for estimating gaseous absorption through atmosphere. K₁-CO3

1. Determine equivalent height for oxygen and water vapour (dependent on location latitude)
2. Adjust values to account for surface temperature.
3. Determine total gaseous attenuation.
4. Determine frequency-dependent specific attenuation coefficients in dB/km for oxygen and water vapour.

The correct sequence of the above procedure is

- a) 2-3-4-1
- b) 4-1-2-3
- c) 3-4-2-1
- d) 1-3-4-2

7. The propagation delay for the range from a ground station to the satellite 42000km is..... K₂-CO4

- a) 0.56sec
- b) 0.14 sec
- c) 3 sec
- d) 0.42 sec

8. Consider the following statements with respect to satellite access. K₂-CO4

1. TDMA frame efficiency can be increased by increasing the frame length and increasing the overhead bits.
2. Digital speech interpolation may be implemented using speech predictive encoded communications.
3. Multiple access technique that is suitable only for digital transmission is FDMA.
4. An important feature of the INTELSAT SCPC system is that each channel is voice-activated.

Which of these statements are correct?

- a) 1,3
- b) 2,4
- c) 1,4
- d) 2,3

9. The following items consist of two statements, one labeled as the “Assertion (A)” and the other as “Reason (R). Examine those two statements carefully and select the answers to these items using the codes given below: K₂-CO5

Assertion (A) : The accuracy of GPS measurements can be increased considerably by using differential GPS techniques.

Reason (R) : The most accurate forms of differential GPS use the relative phase of the many signals in the GPS transmissions to increase the accuracy of the timing measurements.

- a) both A and R are individually true and R is the correct explanation of A b) both A and R are individually true but R is not the correct explanation of A
 c) A is true but R is false d) A is false but R is true

10. Match list I with list II and select the correct answer using the codes given below.

K₂-CO5

List I	List II
A. Mobile satellite services	Ka band
B. Fixed satellite services	L band
C. Direct broadcast satellite service	C band
D. Teledesic	Ku band

Codes: A B C D

- (a) 4 1 2 3
 (b) 3 4 1 2
 (c) 2 3 4 1
 (d) 3 1 4 2

PART B (10 x 2 = 20 Marks)

11. Calculate the semi-major axis of a satellite which is orbiting in the equatorial plane with a period from perigee to perigee of 12 hours. Given that the eccentricity is 0.002. Assume earth radius as 6378 km. K₃-CO1
12. Review the effects of orbital perturbations. K₂-CO1
13. Calculate the gain and beam width of an antenna of diameter 2 m operating at 14GHz. Assume an aperture efficiency of 60%. K₃-CO2
14. Identify the major subsystems of an earth station. K₂-CO2
15. A satellite link operating at 14 GHz has receiver feeder losses of 1.5 dB and a free-space loss of 207 dB. The atmospheric absorption loss is 0.5 dB, and the antenna pointing loss is 0.5 dB. Depolarization losses may be neglected. Calculate the total link loss for clear-sky conditions. K₃-CO3
16. Define G/T ratio of Earth station and state its significance. K₁-CO3
17. In pre assigned FDMA, the pilot frequency is transmitted by one of the earth stations designated as a primary station. What is done in case of the primary station fails? K₃-CO4
18. In a DS-CDMA system, the information bit rate and chip rate are respectively 20kbps and 20Mbps. Determine the processing gain in dB and also determine the noise reduction (in dB) achievable in this system. K₃-CO4

19. List any four applications of remote sensing satellite. K₁-CO5
20. Compare the features of INSAT I and INSAT II systems. K₄-CO5

PART C (6 x 5 = 30 Marks)

21. Examine the location of a satellite in the orbit and derive appropriate equations and give the procedure. K₃-CO1
22. Describe the telemetry, tracking and command facilities of a satellite communication System. K₂-CO2
23. Derive equations for reliability of a satellite. How is reliability improved when redundancy is employed? K₃-CO2
24. A 12GHz receiver consists of an RF stage with gain $G_1=30\text{dB}$ and noise temperature $T_1=20\text{K}$, a down converter with gain $G_2=10\text{dB}$ and noise temperature $T_2=360\text{K}$ and an IF amplifier stage with gain $G_3=15\text{dB}$ and noise temperature $T_3=1000\text{K}$. Calculate the effective noise temperature and noise figure of the system. Take reference temperature as 290K. K₃-CO3
25. Compare and contrast the FDMA and TDMA systems. K₃-CO4
26. Describe the operation of typical VSAT system. State briefly where VSAT systems find widest applications. K₂-CO5

PART D (4 x10 = 40 Marks)

27. Define look angle. Derive the expressions to determine the look angles. K₃-CO
28. Describe the various interferences that affect the satellite link performance and explain as to how these interference effects are taken into account in the satellite link design. K₃-CO
29. Discuss in detail about ATM via satellite with necessary diagrams. K₂-CO
30. Illustrate the GSM frame structure and also explain the GSM architecture with neat block diagram. K₃-CO
