

Code No: **R42043**

**R10**

**Set No. 1**

**IV B.Tech II Semester Regular Examinations, April/May - 2014**

**SATELLITE COMMUNICATIONS**

**(Electronics and Communication Engineering)**

**Time : 3 hours**

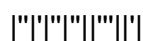
**Max. Marks: 75**

**Answer any Five Questions**

**All Questions carry equal marks**

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- 1 a) Explain about LEO and MEO satellite systems [8]  
b) Explain the general and technical characteristics of a satellite communication system [7]
- 2 a) Define Kepler's laws of planetary motion with relevant mathematical expressions [8]  
b) An earth station has a longitude of  $99.5^{\circ}$  west and latitude of  $29.5^{\circ}$  north. The satellite has a longitude of  $143^{\circ}$  west. Find the azimuth and elevation angle. [7]
- 3 a) Draw and explain the simplified double conversion transponder (bent pipe) for 6/4 GHz band [8]  
b) Draw a diagram to show different forces on a synchronous satellite and explain about attitude control system [7]
- 4 a) Discuss in detail about rain effects in *ku* band [8]  
b) An earth station antenna has a diameter of 35 m, has an overall efficiency of 69%, and is used to receive a signal at 4350 MHz. at this frequency the system noise temperature is 78K when the antenna points at the satellite at an elevation angle of  $28^{\circ}$ . What is the earth station G/T ratio under these conditions? [7]
- 5 a) Compare and contrast pre assigned FDMA and demand assigned FDMA [8]  
b) Discuss clearly the CDMA system with example [7]
- 6 a) Illustrate the operations required for receiving a signal from the satellite using multicarrier earth station [8]  
b) Illustrate the design of electromagnetic-horn radiator [7]
- 7 a) What are the important factors that influence the design of any satellite communication system? Discuss [8]  
b) What do you mean by Globalstar, Ellipso? Explain in detail [7]
- 8 a) Draw the general arrangement of position location with GPS and explain about GPS in detail [8]  
b) Draw the block diagram of C/A code generator and explain [7]



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**Set No. 2**

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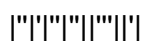
**Time : 3 hours**

**Max. Marks: 75**

**Answer any Five Questions  
All Questions carry equal marks**

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- 1 a) Explain clearly about GEO satellite systems [8]  
b) Write about the future trends of satellite communications [7]
- 2 a) Derive expression for the radius of geosynchronous orbit [8]  
b) Write about the orbital effects in communication system performance [7]
- 3 a) What are two approaches used for equipment reliability in the event of failure of communication capacity of the satellite? Explain [8]  
b) Draw and explain the simplified single conversion transponder (bent pipe) for 6/4 GHz band [7]
- 4 a) Illustrate the procedure for *ku* band down link design [7]  
b) Consider a 4GHz receiver with the following gains and noise temperatures:  $T_{in}=25K$ ,  $T_{RF}=50K$ ,  $T_{IF}=1000K$ ,  $T_m=500K$ ,  $G_{RF}=23$  db,  $G_{IF}=30$ db. Calculate the system noise temperature assuming that the mixer has a gain  $G_m=0$ db. Recalculate the system noise temperature when the mixer has a 10db loss. [8]
- 5 a) Discuss various modulation and multiplexing techniques used with satellite links [8]  
b) Draw the frame structure and explain TDMA [7]
- 6 a) Horn antennas are commonly used as primary radiators in reflector systems, Justify? [8]  
b) Draw the block diagram of TWTA transmitter required for multiple transmitter chains and explain. [7]
- 7 a) What are the four important factors that influence the design of any satellite communication system? Explain [8]  
b) Discuss in detail about Molniya and Elliptical orbits [7]
- 8 a) Discuss in detail the process of satellite signal acquisition [8]  
b) What are the major sources of error in GPS receiver? Discuss in detail [7]



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- 1 a) Write an account of the evolution and growth of communication satellites [8]
- b) What are the applications of satellites? Explain [7]
- 2 a) What are look angles? How do you determine? Explain with the help of neat diagrams [8]
- b) What are orbital parameters required to determine a satellite's orbit? Name and explain them. [7]
- 3 a) The earth subtends an angle of  $17^{\circ}$  when viewed from geostationary orbit. What are the dimensions and gain of the horn antenna that will provide global coverage at 4 GHz. [8]
- b) Draw the bathtub curve for the probability of failure and explain clearly the concepts of equipment reliability, space qualification of communication satellites [7]
- 4 a) Illustrate the ku band uplink design [8]
- b) An earth station antenna has a diameter of 30 m, has an overall efficiency of 68%, and is used to receive a signal at 4150 MHz. at this frequency the system noise temperature is 79K when the antenna points at the satellite at an elevation angle of  $28^{\circ}$ . What is the earth station G/T ratio under these conditions? [7]
- 5 a) What is the basic principle of a direct sequence spread spectrum system and explain [8]
- b) Explain about FDMA and draw the frequency plan for two C-band transponders using FDMA [7]
- 6 a) Draw the block diagram of a general earth station and explain [8]
- b) Draw and explain the receiver subsystem for multicarrier earth station [7]
- 7 a) Discuss in detail the delay and throughput considerations of satellite communication link [8]
- b) What are different satellite constellation designs? Explain any two of them [7]
- 8 a) What is the technique used to increase the accuracy of GPS measurements? Discuss in detail [8]
- b) Write short notes on GPS Receiver Operation [7]

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**Time : 3 hours**

**Max. Marks: 75**

**Answer any Five Questions**  
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- 1 a) Draw the general structure of a satellite communications system and explain [8]  
b) Write about satellite frequency allocations and band spectrum [7]
- 2 a) Explain as to how a satellite is placed into geostationary orbit from earth? [8]  
b) What is station keeping? Explain in detail the N-S and E-W station keeping. [7]
- 3 a) Draw the typical telemetry, tracking, command, and monitoring system and explain how it is helpful in successful operation of a communication satellite [8]  
b) What are the four main types of antennas used in satellites? Explain any two with neat diagrams [7]
- 4 a) Write all the ten steps involved in the satellite communication link design procedure [8]  
b) Thermal noise in an earth station receiver results in a  $(C/N)_{dn}$  ratio of 20 db. A signal is received from a bent pipe transponder with a carrier to noise ratio  $(C/N)_{up}=20\text{db}$ . What is the value of overall  $(C/N)_0$  at the earth station? If the transponder introduces inter modulation products with  $(C/I)$  ratio of 24db. What is the overall  $(C/N)_0$  ratio at the receiving earth station [7]
- 5 a) What is the first multiple access technique used in satellite communication systems? Explain in detail. [8]  
b) Suggest a multiple access technique that can be preferred in satellite communication link when traffic from earth station is intermittent? Discuss. [7]
- 6 a) Draw the basic geometry of reflector antenna and discuss its performance. [8]  
b) What is the equipment required for terrestrial interface? Explain. [7]
- 7 a) Compare different satellite low earth orbits with their advantages and disadvantages. [8]  
b) Discuss the coverage and frequency considerations with regard to low earth orbits. [7]
- 8 a) What is the basic requirement of GPS? Explain in detail about the position location using GPS. [8]  
b) Write short notes on Satellite Signal Acquisition. [7]

