



**B.E DEGREE EXAMINATIONS: APRIL 2015**

(Regulation 2009)

Eighth Semester

**ELECTRONICS AND COMMUNICATION ENGINEERING**

ECE136:Satellite Communication

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. Kepler's first law states that
  - a) The path followed by a satellite around the primary will be an ellipse.
  - b) The path followed by a satellite around the primary will be an sphere
  - c) The path followed by a satellite around the primary will be an circle.
  - d) The path followed by a satellite around the primary will be an Semi circle.
2. Satellite launch sites are invariably located on Eastern seaboard to ensure that
  - a) launch takes place eastward
  - b) expenditure of propulsion fuel is reduced during plane changing
  - c) the satellite achieves circular orbit quickly
  - d) spent rocket motor and other launcher debris falls into the sea
3. \_\_\_\_\_ is a satellite that rotates around the earth in a low-altitude elliptical or circular pattern.
  - a) Geosynchronous satellite
  - b) Nonsynchronous satellite
  - c) Prograde satellite
  - d) Retrograde satellite
4. Rotation of a geosynchronous satellite means its
  - a) three-dimensional stabilization
  - b) drift from stationary position
  - c) wobbling
  - d) three-axis stabilization
5. A satellite beam that covers almost 42.4% of the earth's surface
  - a) Zone beam
  - b) Hemispheric beam
  - c) Spot beam
  - d) Global beam

6. A transponder is a satellite equipment which
  - a) receives a signal from Earth station and amplifies
  - b) changes the frequency of the received signal
  - c) retransmits the received signal
  - d) does all of the above-mentioned functions
7. Is a loss of power of a satellite downlink signal due to
  - a) Atmospheric loss
  - b) Path loss
  - c) Radiation loss
  - d) RFI
8. What is the approximate path loss from satellite-to-earth station?
  - a) 100 dB
  - b) 150 dB
  - c) 175 dB
  - d) 200 dB
9. INMARSAT is the first global mobile satellite communication system operated at
  - a) L-band
  - b) X- band
  - c) C- band
  - d) Ku-band
10. RADARSAT orbit is described as
  - a) Dawn to dusk
  - b) Topographic mapping
  - c) Coastal SAT
  - d) RF bandwidth

**PART B (10 x 2 = 20 Marks)**

11. State Kepler's third law.
12. What are the significance of sub-satellite point.
13. What is the difference between the geodetic, geocentric latitudes?
14. The elliptical eccentric orbit of a satellite has its semi-major and semi-minor axes as 25 000 km and 18 330 km respectively. Determine the apogee and perigee distances.
15. How a satellite is powered during launch phase?
16. Give the difference between KU-band and the C-band receive only systems.
17. An antenna has a noise temperature of 35 K and it is matched into a receiver which has a noise temperature of 100 K. Calculate the noise power density and the noise power for a BW of 36 MHz.
18. Define Saturation flux density.
19. What is mean by DOMSAT, INTELSAT, SARSAT?
20. Name four the applications of Radarsat

**PART C (5 x 14 = 70 Marks)**

21. a) Which type of satellite orbit provides the best performance for a communications network for each of the following criteria:
- (i) Minimum free space path loss.
  - (ii) Best coverage of high latitude locations.

**(OR)**

- b) What factors determine the number of satellites required for a network of NGSO satellites serving a global distribution of mobile earth terminals? Include considerations of frequency of operation, pointing, and tracking as well as adequate coverage.
22. a) Explain what is meant by the geostationary orbit? How do the geostationary orbit and the geosynchronous orbit differ?

**(OR)**

- b) What are the minimum and maximum round trip signal propagation times to a satellite in geostationary orbit, for an allowable elevation angle range of  $90^\circ$  to  $0^\circ$ ? Assume an inclination angle of  $0^\circ$ .
23. a) Draw the block diagram of TT&C and explain its blocks.

**(OR)**

- b) Explain why, for a satellite downlink operating with a fixed antenna gain on the satellite and the ground antenna made as large as possible with mathematical equations, and the link performance is independent of the frequency of operation. Under what link conditions could the frequency become a dependency?
24. a) The effective input noise temperature of a satellite receiver is 30 K when the effect of noise contributions from the antenna and feeder are not taken into consideration. If the receiver is fed from an antenna having a noise temperature of 50 K via a feeder with a loss factor of 2.5 dB, determine the effective input noise temperature of the receiver considering the effect of the antenna and the feeder noise contributions. Assume  $T_i = 290$  K and also that the feeder is at a temperature  $T_i$ . Also compute the noise figure in the two cases in decibels.

(OR)

- b) The angle formed by the slant ranges of two geostationary satellites from a certain Earth station  $5^\circ$ . Determine the longitudinal location of the two satellites given that the two slant ranges of satellites A and B are 42 100 km and 42 000 km respectively. Given that the radius of the geostationary orbit is equal to 42, 164 km.

25. a) A communications satellite transponder with a 40 MHz usable bandwidth operates with multiple FDMA carriers. Each FDMA carrier requires a bandwidth of 7.5 MHz and an EIRP of 15.6 dBw. The total available EIRP for the link is 23 dBw. Assume 10 % guard bands and neglect implementation margins.
- (i) Determine the maximum number of carriers that can access the wireless link.
- (ii) Is the system bandwidth limited or power limited?

(OR)

- b) We wish to evaluate the performance of the standard INTELSAT TDMA network, used for international voice communications. Each TDMA frame consists of two reference bursts per frame, with a variable number of traffic bursts, depending on load demand and service area coverage. QPSK modulation (2 bits/symbol) is used, with a total frame length of 120 832 symbols. The preamble in each traffic burst is 280 symbols long, the control and delay channel is 8 symbols, and the guard band interval is 103 symbols. Calculate the frame efficiency for a frame consisting of 14 traffic bursts per frame.

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