Group - E

8. (a) Give a one liner definition of a satellite. What are the different frequency bands allocated for satellite communication?

   (b) What are the various satellite subsystems that are common in any setup? Write an expression for Friis formula for received power using standard notations.

   (2 + 4) + (2 + 4) = 12

9. Write short notes on any three of the following: **(3 × 4) = 12**
   (i) Frequency planning.
   (ii) Principles of Rocket Propulsion
   (iii) 3G- Mobile communication
   (iv) FDMA
   (v) Spin body stabilization.

CELLULAR AND SATELLITE COMMUNICATION
(ECEN 4281)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
__any 5 (five)__ from Group B to E, taking __at least one__ from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

   (i) Which type of handoff is used in CDMA?
   (a) Soft handoff   (b) Hard handoff
   (c) Soft & hard handoff   (d) None of the above.

   (ii) What is the type of inter-system handoff?
   (a) No handoff   (b) Hard handoff
   (c) Soft & hard handoff   (d) Soft handoff.

   (iii) The coverage & capacity of CDMA system is more than that of GSM system
   (a) true   (b) false
   (c) equal   (d) none of the above.

   (iv) LTE – the full form is
   (a) Long Term Evolution   (b) Low Term Evaluation
   (c) Link Time Establishment   (d) None of these.

   (v) In GSM system, the same pair of frequencies can be shared by
   (a) an adjoining cell of same cluster
   (b) same cell number of an adjoining cluster
   (c) any cell of an adjoining cluster
   (d) (b) or (d).

   (vi) Which technique uses two different antennas to reduce traffic on the same frequency?
   (a) Spatial isolation   (b) Frequency reuse
   (c) Multiplexing   (d) Modulation.

(vii) First generation cellular was called hybrid as
(a) the traffic channel was digital and control channel was analog
(b) only the traffic channel was analog
(c) TDMA/FDMA was applied
(d) none of these.

(viii) What is the reason for shifting from c band to ku band in satellite communication?
(a) Lesser attenuation   (b) More bandwidth
(c) Less power requirements   (d) Overcrowding.

(ix) For GEO, the number of Satellites needed is
(a) 2   (b) 3
(c) 4   (d) 5.

(x) DTH dishes are examples of
(a) Cassegrain antenna   (b) C-band antenna
(c) primary-focus feed type antenna   (d) log-periodic antenna.

Group - B

2. (a) Prove that for a hexagonal geometry, the co-channel reuse ratio is given by $Q=\sqrt{3N}$, where, $N = i^2 +ij+j^2$.

(b) Explain the concept of 'Frequency Reuse'. Define a cluster in a GSM network. In a GSM network, a cluster is formed of 7 cells. There are, in all, 10 clusters. The reuse factor is, therefore, 10, - explain. Explain the fact that reuse factor for CDMA is unity.

6 + 6 = 12

3. (a) Differentiate between adjacent channel and co-channel interference. State at least two methods by which interference can be reduced and explain their working. Only increasing the cluster size (with more number of cells) to reduce interference is not a good approach-justify.

(b) Explain how handoff mechanism works in a cellular system. Why is the phenomenon termed as "make-before-break" for GSM networks? Why is handoff in CDMA called soft one?

(2 + 2 + 2) + 6 = 12

Group - C

4. (a) The channel spacing in GSM system was increased to 200 KHz from 25 KHz with respect to 1G system. Yet, the number of subscribers has remained the same. Explain this paradox.

(b) Draw the block diagram of a typical GSM system. Describe the operations of (i) HLR (ii) GMSC and (iii) VLR.

3 + (5 + 4) = 12

5. (a) What is direct sequence spread spectrum? How is it related to the number of subscribers in a CDMA network? What is near-far problem in CDMA network? How is it solved?

(b) If a transmitter produces 50W of power, express the power in (i) dBm and in (ii) dBμ. If this power is applied to an unity gain antenna with a 900MHz carrier frequency, determine the received power at a free space distance of 1Km. From the antenna. Also find the received power at a distance of 10Kms. Assume unity gain for receiver antenna and a loss factor of 1.

(4 + 3) + (2 + 3) = 12

Group - D

6. (a) Consider a transmit earth station operating at an uplink frequency of 6GHz. The antenna diameter is 7m with efficiency of 60%. The antenna tracking loss and atmospheric attenuation is 1.2dB. The uplink slant range is 37506km. Identify the required output power (dBW) of the HPA system at the antenna feed to provide a -80dBW/m² power flux density at the satellite.

(b) Explain with a diagram the process of launching a satellite in orbits. What do you understand by "powered flight"?

6 + (4 + 2) =12

7. (a) Explain the essential of thermal control segment for a spacecraft.

(b) Outline the meaning of antenna noise temperature and system noise temperature referred to the input. Examine why noise temperature is a useful concept in communication receivers?

4 + (4 + 4) = 12