

**Cellular & Mobile Communication
(DE-1.1, Dec-2007)**

Note: Section A is compulsory. Attempt any four questions from Section-B and any two from Section-C.

Section-A

1. a) Prove that for a hexagonal geometry, the co-channel reuse ratio is given by $Q = \sqrt{3} N$, Where $N=i^2 + ij + j^2$.
- b) What are soft hand off's? Whose typical feature it is?
- c) Define (i) Umbrella cell (ii) Micro cell.
- d) Which parameter do we need to be adjusted to avoid interference when cell splitting is done & why?
- e) What do you understand by blocking probability? Give its typical value.
- f) Comment on the prediction of foliage loss.
- g) How is fading estimated? Give parameters to do the same.
- h) Write relationships to express co-channel interference ratio when a transmitting antenna is placed at the centre of hexagonal cell then shifted to the edge or vertex of the same.
- i) Draw two tiers of cells pattern taking cluster size (or frequency reuse pattern) $K=7$.
- j) Give broadly contrasts among the features of 2.5 G and 3 G.

Section-B

2. Why do cells have hexagonal shape?
3. In mobile communication, there are steps involved in call set up. the channel assignment is one of those steps. Give techniques to assign voice channels to the subscriber. Explain in detail.
4. Compare interference from the first tier of six interferer of six interferes with that from twelve interferes? Comment on the answer obtained.
5. A total of 24 MHz of bandwidth is allocated to a particular FDD cellular telephone system that uses two 30 KHz simplex channels to provide full duplex voice and control channels. Assume each cell phone user generates 0.1 Erlangs of traffic. Assume Erlang B is used. (a) Find the number of channels in each cell for four cell reuse system. (b) If each cell is to offer capacity that is 90% of perfect scheduling, find the maximum number of users that can be supported per cell where omni directional antennas are used at each base station. (c) What is the blocking probability of system in b) when the maximum numbers of users are available in the user pool? (d) If each new cell now uses 120 sectoring instead of omni directional for each base station. What is the new total number of users that can be supported per cell for the same blocking probability as in (c)?
6. What do you understand by coverage hole? Give option available for coverage-hole filler.

Section-C

7. Describe general approach to obtain path i.e. point to point prediction model. Details must include non obstructive, obstructive conditions both.

8. (a) A cellular service provider decides to use a digital TDMA scheme which can tolerate a signal to interference ratio of 15 dB in the worst case. Find the optimal value of N for (a) Omni directional antenna (b) 120 sectoring and (c) 60 sectoring. Should be used? If so, which case (60 or 120) should be used? (Assume a path loss exponent of $n = 4$ and consider trunking efficiency)
- (b) What are special characteristics required for setup-channel, space-diversity and glass mounted antenna types?
9. (a) Assume each user of single base station mobile radio system averages three calls per hour, each call lasting on an average of 5 minutes, (a) What is the traffic intensity for each user? (b) Find the number of users that could use the system with 1% blocking if only one channel is available. (c) Find the number of users that could use the system with 1% blocking if five trunked channels are available. (d) If the number of users you found in (c) is suddenly doubled, what is the blocking probability of five channel trunked mobile radio system? Would this be acceptable performance? Justify why or why not?
- (b) How does CDMA technology work in principle? Give detailed features of GSM and CDMA mobile standards.

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