

**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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Roll No.

Total No. of Questions : 09]

[Total No. of Pages : 02

Paper ID [DE011]

(Please fill this Paper ID in OMR Sheet)

B.Tech. (Sem. - 6th)

CELLULAR & MOBILE COMMUNICATION (DE - 1.1)

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 x 2 = 20)

- a) Explain why FM is better than AM for cellular radio, inspite of its wider bandwidth.
- b) What factors limit the maximum and minimum size of cells?
- c) What is the function of duplexer in a cell phone?
- d) What is meant by the term air interface in a cellular system?
- e) Define cluster.
- f) State the different types of handoff.
- g) What is sectoring?
- h) What is meant by coherence bandwidth? Give the expression.
- i) Define rayleigh fading.
- j) State the operations performed by control channel.

Section - B

(4 x 5 = 20)

- Q2)* Discuss the history of 800 MHz spectrum allocation to cellular systems.
- Q3)* Explain the different techniques of improving coverage and capacity in cellular system.
- Q4)* Explain in detail about trunking and grade of service.
- Q5)* What is multipath propagation and what are its effects? List the factors that influence small scale fading.
- Q6)* Discuss the characteristics of cell site antennas.

Section - C

(2 x 10 = 20)

- Q7)* Describe the impulse response for the multipath radio channel.
- Q8)* (a) Derive the improvement offered by selection diversity combining.
(b) Describe the polarization diversity.
- Q9)* Write a detailed technical note on 3G systems.



Roll No.

Total No. of Questions : 09]

[Total No. of Pages : 02

Paper ID [A0322]

(Please fill this Paper ID in OMR Sheet)

B.Tech. (Sem. - 6th)

CELLULAR AND MOBILE COMMUNICATION (DE - 1.1)

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 × 2 = 20)

- a) Classify the mobile radio transmission systems. Give examples.
- b) What is meant by frequency reuse?
- c) What is cell splitting?
- d) State the operations performed by control channel.
- e) What is the function of base station controller?
- f) Where are repeaters used in cellular system?
- g) Define page.
- h) What are the interfaces used in GSM?
- i) Give the features of CDMA.
- j) What is cochannel interference?

Section - B

(4 × 5 = 20)

- Q2)** Differentiate between analog and digital cellular systems with their operating capacities.
- Q3)** Give the structure of the channels in 800 MHz system with frequency ranges.
- Q4)** Explain in detail about dropped call rate and cell splitting.
- Q5)** Describe the free space propagation model.
- Q6)** Discuss the channel types of GSM system.

Section - C

(2 × 10 = 20)

- Q7)** Draw GSM system architecture and explain it in detail.
- Q8)** (a) With a diagram explain the performance of RAKE receiver.
(b) Explain how diversity receiver can be used to fill the holes.
- Q9)** Explain elaborately about types of handoffs.



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B.Tech. (Sem. - 6th)

CELLULAR AND MOBILE COMMUNICATION

SUBJECT CODE : DE - 1.1 (Elective)

Paper ID : [A0322]

[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 × 2 = 20)

- a) Name the factors which limit the maximum and minimum size of cells?
- b) Give the difference between security and privacy.
- c) What are micro cells? How they differ from macro and Pico cells.
- d) Why TDMA cell phones need duplexer, even though they transmit and receive in different time slots?
- e) What is the difference between call blocking and call dropping?
- f) Discuss the paging function of a cellular system.
- g) Give the relation between maximum number calls per hour per cell and the maximum number frequency channels per cell.
- h) What is the concept of the narrow beam sector?
- i) Differentiate channel sharing and channel borrowing.
- j) For a gain of 9dB with respect to a dipole antenna, find 3dB beam width.

Section - B

(4 × 5 = 20)

- Q2)** Find the desire co channel interference phenomena in a reuse cellular system that employs omni directional antenna system.
- Q3)** Why hand off is necessary for cellular systems? Determine the two types of hand offs based on signal strength and C/I ratio.

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- Q4)** What are the components in a cellular system? Explain briefly.
- Q5)** Discuss about the point to point and area to area prediction model for cell coverage?
- Q6)** Discuss the various techniques to measure the co channel interference.

Section - C

(2 × 10 = 20)

- Q7)** Briefly explain the evaluation of the analog and digital cellular mobile system.
- Q8)** Discuss the concept of frequency management concern to the numbering the channels and grouping into the subsets.
- Q9)** Write short note on followings :
- (a) Leaky feeders.
 - (b) GSM specifications.
 - (c) Mobile to mobile propagation.
 - (d) Fixed channel assignment.



Roll No.

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B.Tech. (Sem. - 6th)

CELLULAR & MOBILE COMMUNICATION

SUBJECT CODE : DE - 1.1 (Elective - I)

Paper ID : [A0322]

[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 × 2 = 20)

- a) What is meant by near far effect? Explain.
- b) What limits the distance from handset to base for cordless phones?
- c) What are the functions of the control channels in AMPS system?
- d) Justify the use of hexagonal cell geometry.
- e) How is co-channel interference reduced in cellular systems?
- f) List the types of small-scale fading.
- g) What is the function of equipment identity register in GSM?
- h) What is the difference between soft and hard handoff.
- i) Give the concept of equal gain combining technique.
- j) Which parameter is used to determine the capacity of cellular systems?

Section - B

(4 × 5 = 20)

- Q2)** Discuss the key features of UMTS.
- Q3)** Explain briefly how multipath occurs in a mobile communication environment.
- Q4)** Sketch and explain the GSM frame structure.
- Q5)** Draw and explain the block diagram of an interference cancellation system.
- Q6)** Discuss the characteristics of cell site antennas?

Section - C

(2 × 10 = 20)

- Q7)** Explain different polarizations of electromagnetic waves and express them in terms of mathematical models.
- Q8)** Describe the frequency management of cellular systems for efficient spectrum utilization and increased number of channels?
- Q9)** What do you understand by non fixed channel assignment? Describe the corresponding algorithms?

