

BITS, PILANI – DUBAI
Academic City, Dubai

Semester II 2008 – 2009
IV Year (EEE/EIE)-Elective
Comprehensive Examination

Course No.: EA C452

Course Title: Mobile Telecommunication Networks

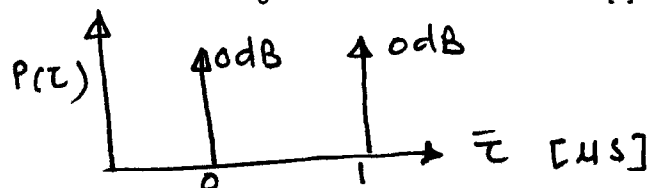
Date: 28.05.2009

Time: 03 hrs

M.M. = 40 (40 %)

- Attempt all Questions, maintain the serial order.
- Assume missing data, if any.

- Q1. (a) What are the two different approaches in regulation regarding mobile phone systems in Europe and the US? What are the consequences? [4]
(b) What limits the number of simultaneous users in a TDM/FDM system compared to CDM system? What happens to the transmission quality of connections if the load gets higher in a cell? [4]
- Q2. (a) What multiplexing schemes are used in GSM and for what purpose? [2]
(b) Looking at the HLR/VLR database approach used in GSM- how does this architecture limit the scalability in terms of users, especially in motion? [2]
(c) How synchronization is achieved in GSM? Who is responsible for this and why is it so important? [2]
(d) If 20 MHz of total spectrum is allocated for a duplex cellular system and each simplex channel has 25 kHz RF bandwidth, find the total number of duplex channels. [2]
- Q3. A cellular system using a cluster size of seven and having radius of 0.4701 Km is operated with 660 channels, 30 of which are designed as control channels so that there are about 90 voice channels available per cell. If there is a potential user density of 9000 users/km² in the system, and each user makes an average of one call/hour and each call lasts 1 minute during peak hours, determine the probability that a user will experience a delay greater than 20 seconds if all calls are queued. [Take, Pr[delay > 0] = 0.5] [6]
- Q4. (a) Write a technical note on Hata Model. [2]
(b) Calculate the RMS delay spread for the following power delay profile and if BPSK modulation is used, what is the maximum bit rate that can be sent through the channel? [3]



- (c) For a Rayleigh fading signal, compute the positive going level crossing rate for $\rho = 1$, when the maximum Doppler frequency is 20 Hz. What is the maximum velocity of the mobile for this Doppler frequency if the carrier frequency is 900 MHz? [3]
- Q5. (a) Draw a neat block diagram of GSM system architecture and explain the functions of each sub system clearly. [4]
(b) Draw the frame structure for GSM and calculate the frame rate. Explain the concept of Multiframe and superframe. [4]
(c) The following abbreviation stands for with respect to mobile networks: [2]
(i) AC (ii) ACI (iii) ADM (IV) AMPS

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**Semester II 2008 – 2009
IV Year (EEE/EIE)-Elective**

Test -2 (Open Book)

Course No.: EA C 452

Course Title: Mobile Telecommunication Networks

Date: 10.05.2008

Time: 50Minutes

M.M. = 20 (20 %)

- **Attempt all Questions, maintain the serial order.**
- **Assume missing data, if any.**

- Q1. In Simulcasting paging systems, there usually is one dominant signal arriving at the paging receiver. In most, but not all cases, the dominant signal arrives from the transmitter closest to the paging receiver. Explain how the FM capture effect could help reception of the paging receiver? Could FM capture effect help cellular radio systems? Please explain. [5]
- Q2. A cellular service provider decides to use a digital TDMA scheme which can tolerate a SIR of 15 dB in the worst case. Find the optimum value of N for
- (i) Omni directional antennas
 - (ii) 120 degree sectoring
 - (iii) 60 degree sectoring
- Should sectoring be used? If so, which case should be used? Consider Trunking efficient and path loss exponent of 4. [5]
- Q3. Explain the advantage and disadvantages of the two ray ground model for reflection in the analysis of path loss.
In the following cases, tell whether the two ray model could be applied, why or why not?
- (i) $h_t = 35\text{m}$, $h_r = 3\text{ m}$, $d = 250\text{m}$
 - (ii) $h_t = 30\text{m}$, $h_r = 1.5\text{ m}$, $d = 450\text{m}$
- What insight does the two ray model provide about large scale path loss that was disregarded when cellular systems used very large cells? [2+2+1]
- Q4. Write a technical note on the capacity of the Cellular CDMA and CDMA Power Control. [2 + 1]
- Q5. The GSM TDMA system uses a 270.833 kbps data rates to support eight users per frame. What is the raw data rate provided for each user? If guard time, ramp up time and synchronization bits occupies 10.1 kbps, determine the traffic efficiency for each user? [2]

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**Semester II 2008 – 2009
IV Year (EEE/EIE)-Elective**

Test -1 (Closed Book)

Course No.: EA C 452

Course Title: Mobile Telecommunication Networks

Date: 02.04.2009

Time: 50Minutes

M.M. = 25 (25 %)

- **Attempt all questions, maintain the Serial Order.**
- **Assume missing data, if any.**

- Q.1. (a) What are the advantages and disadvantages of Wireless LANs? [2]
(b) What are the design goals for Wireless LANs? [2]
(c) Draw the reference model used in wireless communications. [2]
- Q.2. Define the following: [5x2]
- Simulcasting with reference to paging systems
 - Frequency Planning
 - Handoff & handoff Strategies
 - Co Channel Interference
 - Trunking & Grade of Service
- Q.3. A system is operating at 1GHz with two 15 m diameter parabolic antennas at a 90 m distance are to be designed. Can Friis' law be used to calculate the received power? Calculate the link budget from transmitting antenna input to receiving antenna output assuming that Friis law is valid. Compare P_{TX} and P_{RX} and comment on result. [2+2]
- Q.4. A mobile is located 5000 m away from a base station and uses a vertical 8.33 cm antenna (monopole) with a gain of 2.55 dB to receiver cellular radio signals. The E-field at 1 km from the transmitter is measured to be 0.001 V/m. the carrier frequency used for this system is 0.9GHz. Find the effective aperture of the receiving antenna and also find the received power at the mobile using two ray ground reflection models assuming the height of the transmitting antenna is 0.05 km and receiving antenna is 1.5 m above ground. [2+2]
- Q.5. What are the goals in evolving 3 G systems? [1]

NAME: _____

ID NO: _____

**EA C 452: MOBILE TELECOM NETWORKS
SECOND SEM 2008-2009,
FOURTH YEAR - EEE/EIE (ELECTIVE)
SURPRISE QUIZ NO 3**

Dated: 07/05/2009

MM: 05

Complete the following: wrt Comparison

S. No	Approach	TDMA	FDMA	CDMA
1	Idea			
2	Terminals			
3	Signal Separation			
4	Advantages			
5	Disadvantages			

NAME: _____

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EA C 452: MOBILE TELECOM NETWORKS
SECOND SEM 2008-2009,
FOURTH YEAR - EEE/EIE (ELECTIVE)
SURPRISE QUIZ NO 2

Dated: 23/03/2009

MM: 05

1. Complete the following Table:

[2]

Feature	2 G Networks	2.5 G Networks	3 G networks
Databases			
Data Rates			

2. Write the full form of the following with reference to Mobile Communications:

[3]

- i. ACK:
- ii. BCCH:
- iii. BSS:
- iv. CAI:
- v. EDGE:
- vi. Rx:

NAME: _____

ID NO: _____

**EA C 452: MOBILE TELECOM NETWORKS
SECOND SEM 2008-2009,
FOURTH YEAR - EEE/EIE (ELECTIVE)
SURPRISE QUIZ NO 1**

15 Min

Dated: 16 /02/09

MM: 05

Q1.

Define the following:

[02]

a. Base Station

b. Mobile Station:

c. Mobile Switching Center:

d. Transceiver

Q2.

Define and quote the example of each:

[03]

a. Simplex systems

b. Half Duplex systems

c. Duplex systems