

BITS, PILANI – DUBAI
Academic City, Dubai

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

Test -1 (Closed Book)

Course No.: EA C 452

Course Title: Mobile Telecommunication Networks

Date: 19.10.2008

Time: 50Minutes

M.M. = 25 (25 %)

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

- Q1. How interference affects the performance of cellular radio systems?
If a signal to interference ratio of 15dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that should be used for maximum capacity if the path loss exponent is 3, assume there are 6 channel cells in first tier and all of them are at the same distance from the mobile. [5]
- Q2. Write the full form wrt Mobile Communications: [5]
1. AAL 2. ARQ 3. BTS 4. CSD 5. DECT
- Q3. How the absolute decibel level of power in dBW and dBm are defined mathematically? If 0 dBm is equal to 1 mW over some load, express 10 W in units of dBm. [5]
- Q4. A hexagonal cell within a 40cell system has a radius of 1.387 km. A total of 60 channels are used within the entire system. If the load per user is 0.029 Erlangs and $\lambda = 1$ call/hour, compute the following for an Erlang C system that has a 5% probability of a delayed call: [6]
- a) How many users / km² will this system support? (Take traffic intensity as given data as 9 Erlangs)
- (b) What is the probability that a delayed call will have to wait for more than 10 Sec?
- (c) What is the probability that a call will be delayed for more than 10 Sec?
- Q5. Draw the timing diagram illustrating how a call to a mobile user initiated by a landline subscriber is established and vice versa. [2]
- Q6: Discuss the limitations in wireless networking. [2]

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Test -2 (Open Book)

Course No.: EA C 452

Course Title: Mobile Telecommunication Networks

Date: 27.11.2008

Time: 50Minutes

M.M. = 20 (20 %)

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

Q1. Define Sensitivity of a receiver and on what factors it depends?

A commercial mobile receiver for data transmission is specified with a sensitivity of -90dBm. Assuming a 100 mW transmitter and free space path loss between the transmitting and receiving isotropic antennas, what is the radius of the service area of this receiver at a transmission frequency of 800 MHz?

Clearly mention the formulae used and its all parameters in detail.

[1+4]

Q2. Prove that for hexagonal geometry, the co-channel reuse ratio is given by $Q = \sqrt{3N}$ where N is $i^2 + ij + j^2$.

[4]

Q3. Assume a receiver is located 10 km from a 50 W transmitter. The carrier frequency is 6 GHz and free space propagation is assumed, find:

- Power at the receiver
- Magnitude of the E-field at the receiver antenna
- rms voltage applied to the receiver input, assuming that the receiver antenna has purely real impedance of 50 Ohm and is matched to the receiver

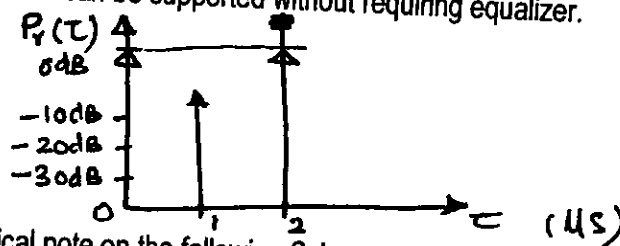
[1+1+2]

Q4. A local spatial average of a power delay profile measured at 900 MHz is shown in fig 1:

Calculate

- rms delay spread and mean excess delay for the channel
- Maximum excess delay (20 dB)
- If the channel is to be used with a modulation that requires an equalizer whenever the symbol duration T is less than $10\sigma_{\tau}$, determine the maximum RF symbol rate that can be supported without requiring equalizer.

[1+1+2]



Q5. Write a technical note on the following Schemes used in wireless communication:

- TDMA
- FDMA
- CDMA

[1+1+1]

NAME: _____

ID NO: _____

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

Dated: 24/09/2008

MM: 05

1. Complete the following Table:

[2]

Feature	Second Generation N/W	2.5 G Networks	3 G networks
Data Rates			
Applications			

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

[3]

- i. ACA: _____
- ii. BERSIM: _____
- iii. BSC: _____
- iv. CAI: _____
- v. IMT 2000: _____
- vi. Tx: _____

NAME: _____

ID NO: _____

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

Dated: 27 /10/2008

MM: 05

1. The time over which a call may be maintained within a cell, without handoff, is called the _____ [1]
2. The ability of user to access a trunked system during busiest hour is called _____ [1]
3. Define Isotropic radiator. [1]
4. Find the far field distance for an antenna with maximum dimension of 2 m and operating frequency of 900 MHz. [1]
5. In free space, the power flux density P_d expressed in W/m^2 is given by: [1]

NAME: _____

ID NO: _____

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

Dated: 29/11/2008

MM: 05

Q1. Draw the frame structure of the TDMA.

[3]

Q2. In any wireless communications systems, which is TDMA/FDD based and it is using 50 MHz for the downlink, which is broken into radio channels of 400 kHz. If 8 speech channels are supported on a single radio channel and no guard band is used, find the number of simultaneous users that can be accommodated.

[2]

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Semester I 2008 – 2009
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Comprehensive Examination

Course No.: EA C452

Course Title: Mobile Telecommunication Networks

Date: 30.12.2008

Time: 03 hrs

M.M. = 40 (40 %)

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

- Q1. (a) Which of the following systems cannot transmit in both directions (duplex or semi duplex)? [2]
i. Cell phone ii. Cordless Phone iii. Pager iv. Truncking Radio
v. TV broadcast
- (b) Assuming that speech can be digitized with 10 Kbit/s, compare the difference in the number of bits for a 10 Sec voice message with a 128 letter pager message. [2]
- (c) What are the main problems in sending very high data rates from an MS to a BS that is far away? [2]
- (d) Name the factors that influence the market penetration of wireless devices. [2]
- Q2. (a) Antenna gain is usually given in relation to an isotropic antenna. It can be shown that the effective area is $A_{iso} = \lambda^2 / 4\pi$. Compute the antenna gain G_{par} of a circular parabolic antenna as a function of its radius r , where the effective area is $A_c = 0.55A$ and A is the physical area of the opening. [4]
- (b) Calculate the Brewster angle for a wave impinging on ground having a permittivity of 4? [2]
- (c) Write a technical note on signal penetration into buildings. [2]
- Q3. (a) Determine the proper spatial sampling interval required to make small scale propagation measurements which assume that consecutive samples are highly correlated in time. How many samples will be required over 10m travel distance if f_c is 1900 MHz and velocity is 50 m/s. What is the Doppler spread for the channel? [4]
- (b) Write the full form of the following wrt wireless communications. [4]
1. AWGN 2. BRAN 3. CPFSK 4. DFT
- Q4. (a) Describe with the help of neat diagram, the frame structure for GSM showing frame, multiframe and superframe. [4]

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(b) Consider the following billing problem: Subscriber A is Swedish but temporarily based in Denmark. Subscriber B is in Finland and Subscriber C is in France. Subscriber C forwards all the calls to Subscriber D in England. A calls B, and wants to conference in subscriber C. As C has call forwarding ON, the call goes to D and that subscriber is then active in phone conference. Who pays which fees in terms of international call fee, roaming fee, conference fee etc? [4]

Q5. For EEE:

(a) A conventional AM signal is of the form $S_{AM} = [1 + a \cos \omega_{mt} + a \cos 2\omega_{mt}] \cos \omega_{ct}$; $a > 0$. Show that, to avoid distortion, $a \leq 8/9$ [4]

(b) Write a technical note on Diversity techniques. [4]

For EIE

(a) An unmodulated carrier wave has a normalized power P_c . When the carrier is amplitude modulated to a depth of μ by a sinusoid, the power increases to P_t . Formulate a relation between μ , P_c and P_t . [4]

(b) Write a technical note on CDMA technique. [4]