BITS, PILANI – DUBAI
Academic City, Dubai

Semester II 2009 – 2010
IV Year (EEE/EIE)-Elective
Comprehensive Examination

Course No.: EA C452 **Course Title:** Mobile Telecommunication Networks

Date: 26.05.2010 **Time: 03 hrs** **M.M. = 40** (40 %)

- ***Attempt all question in serial order, marks will be deducted in case of violation.***
- ***Assume suitable data/assumptions, if needed. Also write the formula used, if any.***

Q1. [a] What are the main problems when transmitting data using wireless systems that were made for voice transmission? What are the possible steps to mitigate the problems and to raise efficiency? [3]
[b] What are the limitations of a GSM cell in terms of diameter and capacity (voice & data) for the traditional GSM, HSCSD, and GPRS? How can the capacity be increased? [3]

Q2. [a] Describe with the help of neat diagram, the frame structure for GSM showing frame, multiframe and superframe. [3]
[b] A hexagonal cell within a 4 cell system has a radius of 1.387km. A total of 60 channels are used within the entire system. If the load/user is 0.029 Erlangs and λ = 1 call/hr, compute for an Erlang C system that has 5% probability of a delayed call: (take *for 5% probability of delay, C=15, Traffic intensity as 0.9 Erlang*)

1. How many users per square km will this system support? [2]
2. What is the probability that a delayed call will have to wait for more than 10sec? [3]

Q3. [a] Explain the term interference in the space, time, frequency and code domain. What are the counter measures in SDMA, TDMA, FDMA and CDMA systems? [3]
[b] A mobile is located 5 km away from a base station and uses a vertical $\lambda/4$ monopole antenna with a gain of 2.55 dB to receive radio signals. The E field at 1 km from the transmitter is measured to be 0.001V/m. The carrier frequency used in this system is 900 MHz.

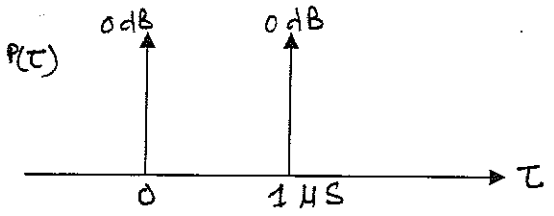
a. Find the length and the effective aperture of the receiving antenna. [2]
b. Find the received power at the mobile using 2 ray ground model assuming the height of the transmitting antenna is 50 m and the receiving antenna is 1.5 m above the ground. [3]

Q4. [a] With a focus on security, what are the problems of WLANs? What level of security can WLANs provide, what is needed additionally and how far do the standards go? [3]
[b] For a Rayleigh fading signal, compute the positive going level crossing rate for ρ=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] If Bluetooth is commercial success, what are the remaining reasons for the use of IR transmission for WLANs? [3]
[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? See Fig. 1 [3]

Q6. [a] What are the main problems of signal propagation? Why do radio waves not always follow a straight line? Why reflection both useful and harmful? [3]
[b] If a normal GSM time slot consists of 6 trailing bits, 8.25 guard bits, 26 training bits and 2 traffic bursts of 58 bits of data, find the frame efficiency? [3]

Fig. 1



BITS, PILANI – DUBAI
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Semester II 2009 – 2010
IV Year (EEE/EIE)-Elective

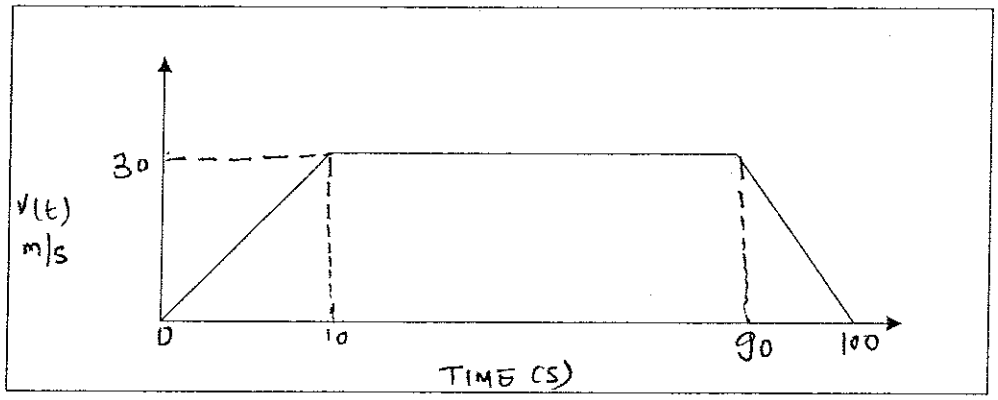
Test -2 (Open Book)

Course No.: EA C 452 **Course Title:** Mobile Telecommunication Networks
Date: 09.05.2010 **Time: 50**Minutes **M.M. = 20** (20 %)

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

Q1. Given an indoor path loss model of the form: PL(d)db = 40 +20logd + Σ FAF, d >=1m, find the mean received power between 03 floors of a building if FAF is 15 dB per floor. Assume the transmitter radiates 20 dBm and unity gain antennas are used at each end and straight line path between T-R is 15 m through the floors. [4]

Q2. An automobile moves with velocity v(t) as shown in the figure below. The received mobile signal experiences multipath Rayleigh fading on a 900 MHz CW carrier. What is the average crossing rate and fade duration over the 100 S intervals? Assume ρ = 0.1 and ignore large scale fading losses. [4]



Q3. A 2 MHz carrier with an amplitude of 4V is frequency modulated by a modulating signal m(t) = sin (1000πt). The amplitude of the modulating signal is 2 V and the peak frequency deviation was found to be 1 kHz. If the amplitude and frequency of the modulating signal are increased to 8V and 2 kHz respectively, derive an expression for the new modulated signal. [4]

Q4. Discuss ground reflection (Two ray) model for reflection in mobile radio propagation. In the following cases, tell whether the two ray model could be applied, why or why not?
(i) ht = 35m, hr = 3 m, d = 250m
(ii) ht = 30m, hr = 1.5 m, d = 450m
What insight does the two ray model provide about large scale path loss that was disregarded when cellular systems used very large cells? [4]

Q5. Write a technical note on fading effects due to Doppler Effect in Mobile environment. [4]

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Semester II 2009 – 2010
IV Year (EEE/EIE)-Elective

Test -1 (Closed Book)

Course No.: EA C 452 **Course Title:** Mobile Telecommunication Networks

Date: 28.03.2009 **Time: 50**Minutes **M.M. = 20** (20 %)

Attempt all questions, maintain the Serial Order.

Q1. ***Answer in brief but to the point:*** [5 x 2]

a. Why can waves with a very low frequency follow the earth surface? Why are they not used for data transmission in computer networks?

b. Why does the ITU-R only regulate "lower" frequencies (up to some hundreds of GHz) and not higher frequencies like, in THz?

c. Why is the international availability of the same "ISM" bands important?

d. Is a directional antenna useful for mobile phones? Why? How can gain of an antenna be improved?

e. What are the basic differences between wireless WANs and WLANs and what are the common features, with respect to mode of operation, administration, frequencies, capabilities of nodes, services, national/international regulations.

Q2. Find the mean path loss using Okumura's Model for separation distance of 50 Km, h_{te} = 50 Km, h_{re} = 10 m in a suburban environment. If the base station transmitter radiates an EIRP of 10 kW at a carrier frequency of 900MHz, find the power at the receiver, assuming unity gain antenna. Also take Amu = 43dB and G_{AREA} = 9 dB. [5]

Q3. If a signal to interference ratio of 16dB 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]

Name: ..... ID No: ....

BITS, PILANI – DUBAI

SECOND SEMESTER 2009 – 2010

Course Code: EA C452
Course Title: MTN
Duration: 20 minutes

FOURTH YEAR-EEE/EIE
QUIZ 2

Date: 07.04.10
Max Marks: 10
Weightage: 10%

Instructions:
1. Attempt all questions.

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 3 m and operating frequency of 900 MHz. [2]

5. Calculate the Brewster Angle for a wave impinging on ground having a permittivity of $\epsilon_r = 4$. [2]

6. Write down the factors that influences small scale fading in mobile communications: [2]

i. _____

ii. _____

iii. _____

iv. _____

7. Write down the Friis free space equation: [1]

Name: ..... ID No: ....

BITS, PILANI – DUBAI

SECOND SEMESTER 2009 – 2010

Course Code: EA C452
Course Title: MTN
Duration: 20 minutes

FOURTH YEAR-EEE/EIE

Date: 22.02.10
Max Marks: 10
Weightage: 10%

Instructions:
1. Attempt all questions.

1. *Write the full forms the following abbreviations with reference to Mobile Communications:* *[2]*

   1. ACA : _____

   2. BSC : _____

   3. CAI: _____

   4. dBi : _____

2. *Fill with appropriate word:* *[3]*

   1. Bluetooth operates in the _____.
   2. Bluetooth uses a _____TDD scheme.
   3. Each Bluetooth radio channel has _____ BW.

3. *Define the following:* *[3]*

   a. Base Station

b. Mobile Switching Center:

c. Transceiver

4. Complete the following Table: *[2]*

Feature	2G N/W	3 G N/W
Databases		
Data Rates		