Course Code: **EA C452**  COMPREHENSIVE EXAMINATION  Date: **12.01.2012**
Course Title: **MOBILE TELECOMMUNICATION NETWORKS**  Max.Marks:**80**
Duration: 3 HRS  Weightage: **40%**
**Instructions**:  1.ANSWER all questions in sequence of their order.
2. Make assumptions, if any, but explicitly indicate the assumptions made

| | | |
|---|---|---|
| **1.** | A. Draw timing diagram for call establishment between two mobile users. | **5** |
| | B. What is frequency reuse? Why is it required in cellular mobile communication? Derive the necessary expression for frequency reuse factor? | **5** |
| **2.** | A. Draw your own Mobile assisted handoff algorithm by flow chart based on received power strength and analyze in details about issues related with handoff. | **5** |
| | B. A cellular system which uses TDMA has SIR of 15dB in the worst case. Find the optimal value of N for a) Omni directional antennas b) $120^\circ$ sectoring and c) $60^0$ sectoring. Should sectoring be used? IF so which case ($120^\circ$ or $60^0$) should be used? (Assume a path loss exponent of n=4 and consider trunking efficiency.) | **5** |
| **3.** | A. A receiver in an urban cellular area detects a 1mW signal at d=do=1 meter from the transmitter. In order to mitigate co channel interference effects, It is required that the signal received at any base station receiver from another base station transmitter which operates with the same channel must be below -100dBm.A measurement team has determined that the average path loss exponent in the system is n=3, determine the major radius of each cell if a 7-cell reuse pattern is used, What is the major radius if a 4 cell reuse pattern is used? | **5** |
| | B. Design reverse link for a cellular mobile communication system, if mobile phone transmits 1mwatts of power at a frequency of 900 MHz through an antenna having 0dB from a distance of 5km.The receiver power at base is 10μwatts. | **5** |
| **4.** | A. Derive expression for finding received power by two ray model. | **6** |
| | 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 cellular radio signals. The E filed at 1 km from the transmitter is measure to be $10^{-3}$ V/m. The carrier frequency is 900 Mhz.(a) Find the length and the gain of receiving antenna (b)Find the received power at the mobile using the two ray model assuming the height of the transmitting antenna is 50m and the receiving antenna is 1.5 m above ground | **6** |

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Duration: 3 HRS  Weightage: **40%**

**Instructions:**  1.ANSWER all questions in sequence of their order.

2. Make assumptions, if any, but explicitly indicate the assumptions made

| | | |
|---|---|---|
| **5.** | A certain city has an area of 2120 sq.km has to be setup for cellular mobile communication system. A 7 cell reuse pattern is considered for cellular system. Each cell is of radius 4 km. The city is allocated to use 40MHz of spectrum with a simplex channel bandwidth of 30kHz.This system uses a FDD. Assume a GOS of 2% for an Erlangs B system is specified .If the offered traffic per user is .04 Erlangs, Compute (a) number of cells in the service area,(b) the number of channel per cell,(c)traffic intensity of each cell ,(d) the maximum carried traffic,(e) the total number of users that can be served for 2% GOS,(f) the number of mobile per channel and (g) theoretical maximum number of users that could be served by the system. | **10** |
| **6.** | A. The base station transmitter power is increased from $P_{t1}$ to $P_{t2}$ where as receive power at mobile is changed from $P_{r1}$ to $P_{r2}$.Prove that the radius of a new cell $r_2 = \left( \dfrac{P_{r1}P_{t2}}{P_{r2}P_{t1}} \right)^{\frac{1}{4}} . r_1$. | **6** |
| | B. Determine the number of channels per cell for case of (i) n=3propagation path loss and (ii) n=4 propagation path loss  if minimum C/I is 14dB.Find the cluster size of cellular system if channel bandwidth is 30kHz and spectrum allocation is 20MHz. | **6** |
| **7.** | Draw TDMA frame structure .Find out frame efficiency if synchronization bits are 32bits, ramp up bits are 32, control bits are 32, FEC bits are 32 and payload bits are 1024.Find out number users that can be accommodated if each user transmits 64 PCM bits. | **6** |
| **8.** | A. Write various action taken place when mobile initiates call and when call is going on. | **5** |
| | B. Draw block diagram of FH –CDMA system and explain each block. | **5** |

# BITS, PILANI – DUBAI CAMPUS
**I SEMESTER 2011 – 2012  IV YEAR EIE/EEE- Evaluation Component :  TEST-2[OPEN BOOK]**
Course Code: **EA C452** Course Title: **MOBILE TELECOMMUNICATION NETWORKS**      Date: **22.12.2011**
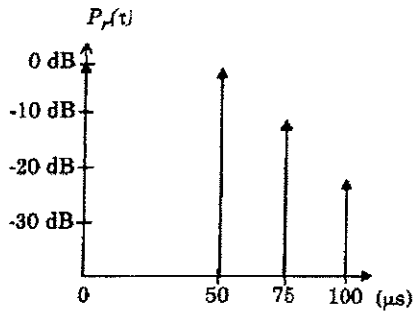**Duration: 50 mts**                                              **Max. Marks: 40 Weightage: 20%**
Note:-   1. ANSWER All QUESTIONS
         2. Make assumptions, if any, but explicitly indicate the assumptions made

Q1. Find the RMS delay spread for power delay profile given in following figure and coherence band width.                                                                    [5]



Q2. (a) If modulating signal $m(t) = \cos \omega_m t$ is modulated by carrier $c(t) = \cos \omega_c t$ by using product modulator. Write how to get back m (t) from modulated signal. Prove it          [5]

b) Calculate bit rate of PCM system which uses BPSK transmitter as shown in figure given below.                                                                          [6]
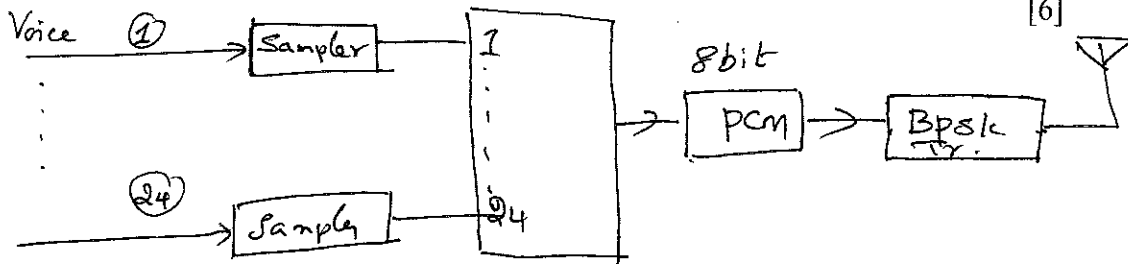


Q3. A continuously operating coherent BPSK system makes errors the average rate of 200 errors per Day. The data rate is 1000 bits/s. The noise spectral density is $N_o=10^{-10}$ W/Hz.
   (a)  Find the average BER                                                     [5]
   (b)  If the received average signal power is adjusted $10^{-6}$ W, find BER.   [5]

Q5. (a) Find out code and its length generated by following PN sequence generator employed
   DS - CDMA.                                                                    [8]
   (b)  Find out coded bit stream when 0 is transmitted using this CDMA system    [2]



PN Sequnce
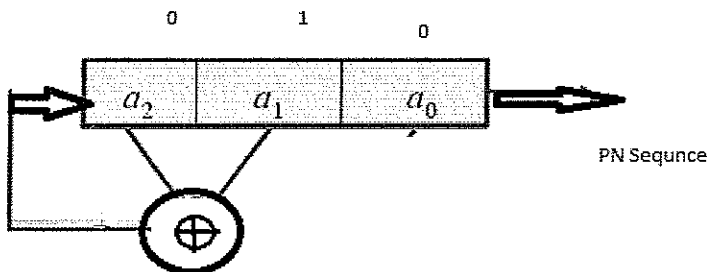
1.

Q6. (a) Draw TDMA frame structure .Find out frame efficiency if synchronization bits are 32bits, ramp up bits are 32, control bits are 32, FEC bits are 32 and payload bits are 1024.        [4]

# BITS, PILANI – DUBAI CAMPUS
## I SEMESTER 2011 – 2012
Course Code: **EA C452**     TEST-1 , **IV** 4/r *ECE/EEE* Date: 03.11.2011

Course Title: **MOBILE TELECOMMUNICATION NETWORKS**     Max.Marks:**50**
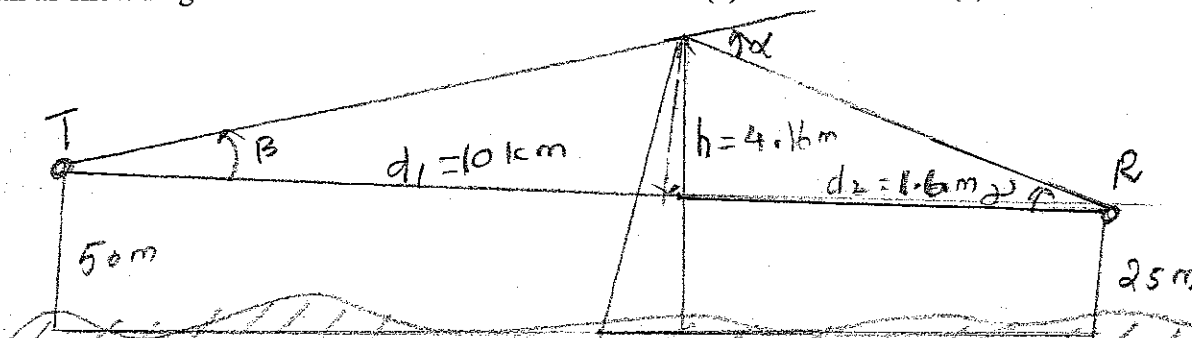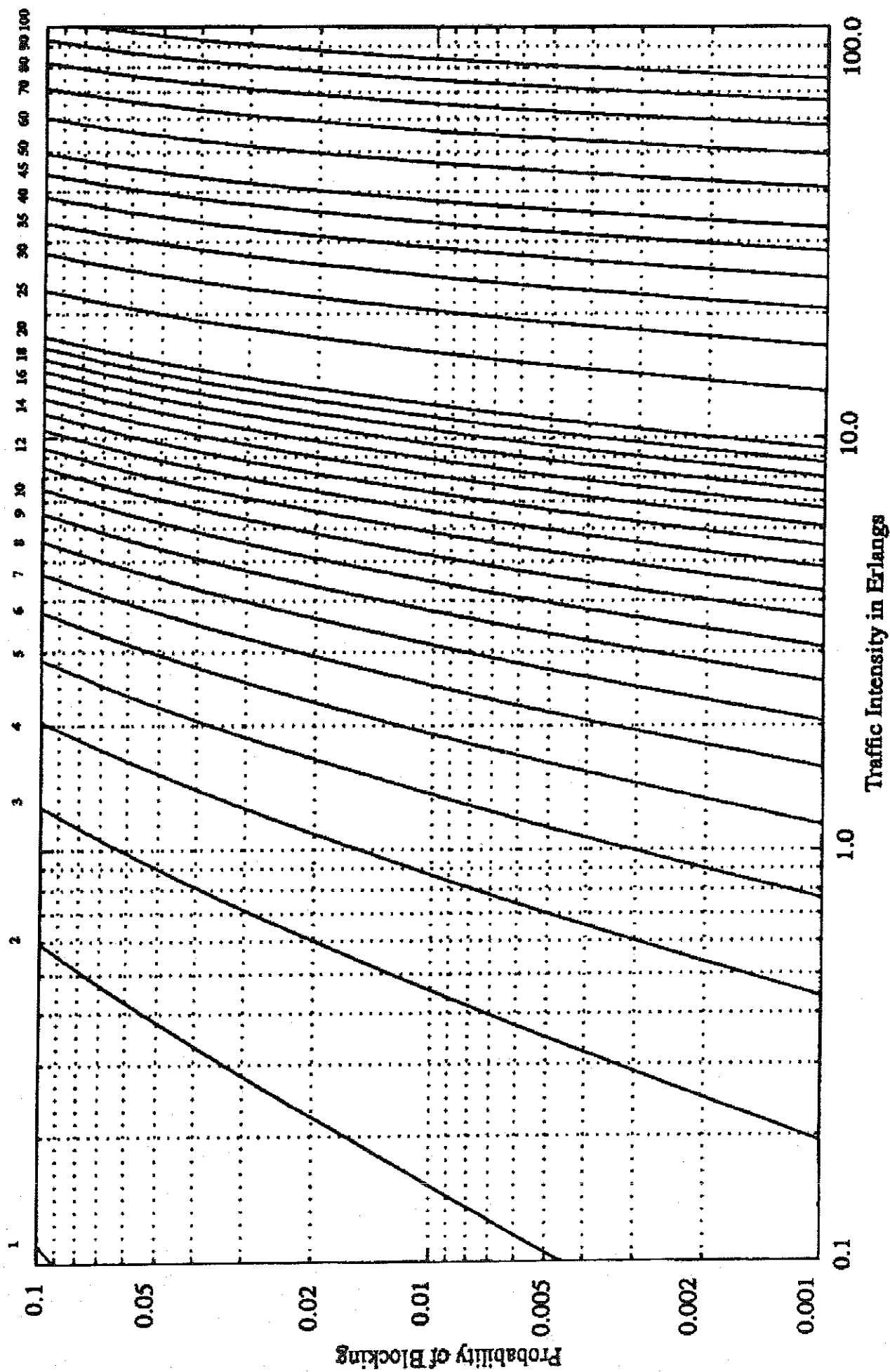
Duration: **50 minutes**     Weightage: **25%**

**Instructions**: 1.ANSWER all questions in sequence of their order.

           2. Make assumptions, if any, but explicitly indicate the assumptions made

| | | |
|---|---|---|
| 1. | Prove how C/I is obtained equal to 18dB in mobile communications. | **[6 M]** |
| 2. | a) Draw your own handoff flow chart algorithm based on velocity<br><br>b) Analyze in details about issues related with handoff. | **[6 M]** |
| 3. | A cellular system which uses TDMA has SIR of 15dB in the worst case. Find the optimal value of cluster size N for **a)** Omni directional antennas **b)** $120^\circ$ sectoring and **c)** $60^0$ sectoring. Should sectoring be used? IF so which case ($120^\circ$ or $60^0$) should be used? (Assume a path loss exponent of n=4 and consider trunking efficiency.) | **[6 M]** |
| 4. | A certain city has an area of 2075 sq.km and is covered by using a 7 cell reuse pattern cellular system. Each cell is of radius 4 km. The city is allocated to use 40MHz of spectrum with a full duplex channel bandwidth of 60kHz.Assume a GOS of 2% .Erlangs B system is specified .If the offered traffic per user is 0.03 Erlangs, Compute **(a)** number of cells in he service area,**(b)** the number of channel per cell,**(c)**traffic intensity of each cell ,**(d)** the maximum carried traffic, **(e)** the total number of users that can be served for 2% GOS,**(f)** the number of mobile per channel and **(g)** theoretical maximum number of users that could be served by the system. | **[12 M]** |
| 5. | Explain the advantages and disadvantages of the two ray ground reflection model in the analysis of path loss .In the following cases explain why or why not two ray model could be applied .Let d>10($h_t$+$h_r$) be the condition required to adopt this model for use. **(a)** $h_t$ = 35m $h_r$=3m and d=250m and **(b)** $h_t$ = 30m $h_r$=1.5m and d=450m . | **[6M]** |
| 6. | Obtain the expression for following and also calculate the same established by two ray diffraction path as shown figure .Assume h =4.16m and f=900 MHz **(a)** Path difference **(b)** Phase difference.<br><br> | **[8 M]** |
| 7. | Write design procedure of reverse link for a cellular mobile communication system. If mobile phone transmits 1 mill watts of power at a frequency of 900 MHz through an antenna having gain 0dB from a distance of 5km.The power received at base is 10 nano watts. | **[6 M]** |

3.6 The Erlang B chart showing the probability of blocking as functions of the number of channels and traffic intensity in Erlangs

# BITS, PILANI – DUBAI CAMPUS

## I SEMESTER 2011 – 2012

Version B

Course Code: **EA C452**  **Quiz-2**  Date: 12/12/2011

Course Title: MOBILE COMMUNICATION NETWORKS.  Max Marks: **14**

Duration: **20 minutes**  Weightage: 7%

**Instructions:**  1.ANSWER all questions with *most appropriate answer(s)*, at the space provided.

2. Make assumptions, if any, but explicitly indicate the assumptions made

3. Write on back side if the space is insufficient.

1. Compute the change in frequency due to mobile user travelling at 60 km/s (i) towards base station (ii) and away from base station if the transmitter transmits 1850 MHz  **[2]**

2. Mobile radio channel is modeled as _____ filter and time varying _____ response.

**[2]**

3. What is ISI? Why is it occurring in mobile environment?  **[2]**

4. Determine coherence time and coherence bandwidth if mobile user travels with a velocity of 50 m/s, receives a frequency of 1900 MHz and RMS delay spread is 1.37 µs  **[2]**

5. What is the probability that makes to receive signal of magnitude 0.001, if standard deviation 0.5     [2]

6. What is frequency selective fading?                                                            [2]

7.   If s(t) is input , r(t) is the output and h(t, r) is the impulse response of channel used for mobile communication, find the type of fading occurred due to it.                                    [2]
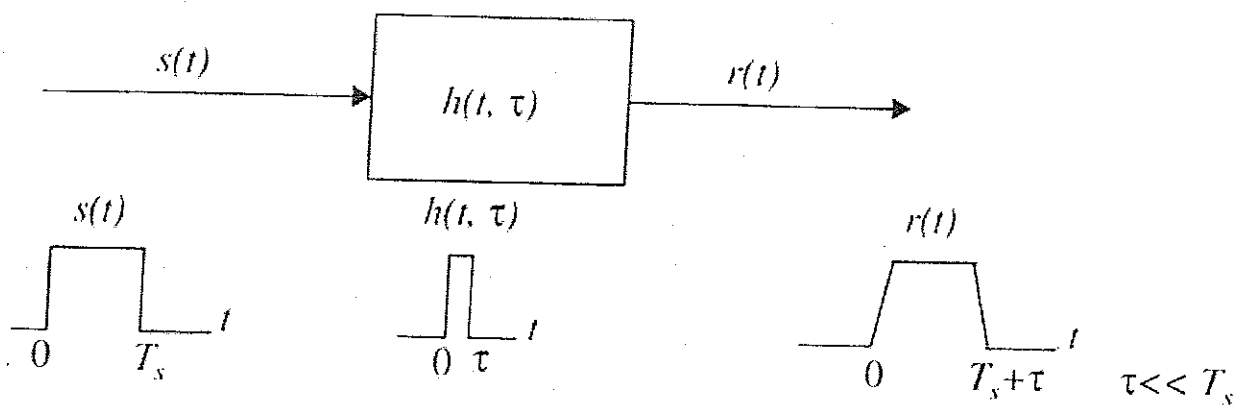
NAME:                                                    ID NO:

### *BITS-Pilani Dubai, International Academic City, Dubai*
### *IV YEAR ECE/EEE*

Evaluation Component :  QUIZ-I
## EA C452 MOBILE TELECOMMUNICATION

**Date: 3<sup>rd</sup> November 2011**          **Max. Marks: 16**

**Duration: 20 mts**                          **Weightage: 8%**

Note:-  1. ANSWER All QUESTIONS
        2. Make assumptions, if any, but explicitly indicate the assumptions made

1. What is Full Duplex communication system? Give an example for simplex system.

   **[1 Marks]**

2. Write the bandwidth employed for each channel employed, type of duplex system and type of modulation used in AMPS standard.          **[1 Marks]**

3. How does MSC identify location of called mobile subscriber?.          **[1 Marks]**

4. How is capacity of mobile telecommunication increased?          **[1 Marks]**

5. Differentiate adjust channel interference and Co channel interference.          **[2 Marks].**

6. How is adjacent channel interference reduced? How is Co channel interference reduced?          **[2 Marks]**

7. Find out the required value of Q and cell radius if K=7, S/I=18 dB, $\gamma=4$ and frequency reuse distance2300m. **[2 Marks]**

8. Express 0.1 milli watts of power transmission in dBm **[2 Marks]**

9. Calculate number traffic intensity for a cell site if it has 200 calls per minute and each call has 1.76 minutes average calling time. **[2 Marks]**

10. Calculate life of battery used in a mobile if it draws 300mA current during call if mobile is used continuously. Assume battery capacity is 1050mA-H **[2 Marks]**