NAME: ID NO:

BITS-Pilani Dubai, International Academic City, Dubai

IV YEAR EIE/EEE

Evaluation Component: COMPREHENSIVE EXAMINATION [Closed Book]

EA C452 MOBILE TELECOMMUNICATION NETWORKS

Date: 30th May 2011 **Max. Marks: 80**

Duration: 3 Hrs **Weightage: 40%**

Note: - 1. ANSWER All QUESTIONS

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

1.

I.Draw Mobile phone circuit diagram and explain principle of operation of each block. **[5]**

II.Draw timing diagram for establishing call setup between land line and mobile. **[5]**

2.

I.Develop your own handoff algorithm based on time parameter. **[5]**

II.Show that the frequency reuse distance $D = \sqrt{3N}.R$, where N is cluster size and R is the radius of the cell. **[5]**

3. A city has an area of 1800 square kilometer and is covered by a cellular system using 7 cell reuse pattern. Each has a radius of 6 km and the city is allocated ~~50~~ 30 MHz of spectrum with a full duplex channel band width 60khz.Assume a GOS of 2% for an Erlang B system .If the offered traffic per user is .03 Erlang, calculate

(i) Number of cells in the service area

(ii) Number of channels per cell

(iii) Traffic intensity of each cell

(iv)Maximum carried traffic

(v) Total number of users can be served

(vi) Number of mobile users per channel and

(vii) Maximum numbers of user served by system at a time. **[10]**

4. A mobile phone receiver detects a 1mW signal at a distance of $d = d_o = 1$ meter from the base station transmitter. In order to mitigate co channel interference effects, t 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.

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The 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 seven cell reuse pattern is used. What is the major radius if a four cell reuse pattern is used? **[5]**

5. Assume a receiver located 10km from a 50W transmitter. The carrier frequency is 1900 MHz, free space propagation is assumed , the gain of receiving antenna and transmitting antenna is $G_r = 2 \& G_t = 1$,find **[10]**

I. The power at the receiver

II. Magnitude of E field at the receiver antenna

III. Open circuit rms voltage applied to the receiver input having matched real impedance of 50Ω

IV. Find the received power at the mobile by two ray ground reflection if the height of transmitting antenna is 50m and receiving antenna is 1.5m above ground if the reflection is -1.

6.

I. Determine number analog channels per cell for the case of n=4 propagation path loss, where minimum acceptable C/I =18dB.What is the appropriate cluster size for the system. Assume the channel bandwidth is 20 kHz and the total spectrum allocation of 30MHz. **[5]**

II. A signal within a mobile system undergoes time spreading. the symbol rate R_s=20000 symbols/sec. Channel measurements indicate that mean excess delay is 10μS,while the second moment of the excess delay is $1.8X10^{-10}$ s^2 .Calculate

a. Coherence bandwidth if correlation of 0.9 and 0.5

b. Find whether the signal will undergo frequency selective fading or not

[5]

7. Why GMSK is preferred for mobile communication? Draw GMSK transmitter and receiver. Derive the expression $S_{MSK}(t) = \sqrt{\frac{2E_b}{T_b}}.\cos[2\pi f_c t - m_I(t).m_Q(t)\frac{\pi t}{2T_b} + \varphi_k]$ of modulated signal. **[8]**

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8. A digital cellular TDMA system uses a 42 kbps data rate to support 3 users per frame. Each user occupies 2 of the 6 time slots per frame. **[8]**

I. What is the raw data arte provided for each user?

II. If the frame efficiency is 80% and the frame duration is 6.667mS, determine the number of information bits sent to each user per frame.

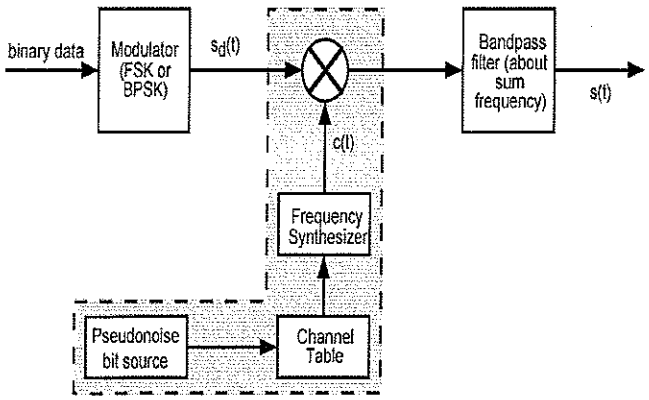
III. If half rate speech coding is used and 6 users per frame are accommodated, determine the number of information bits provided for each user.

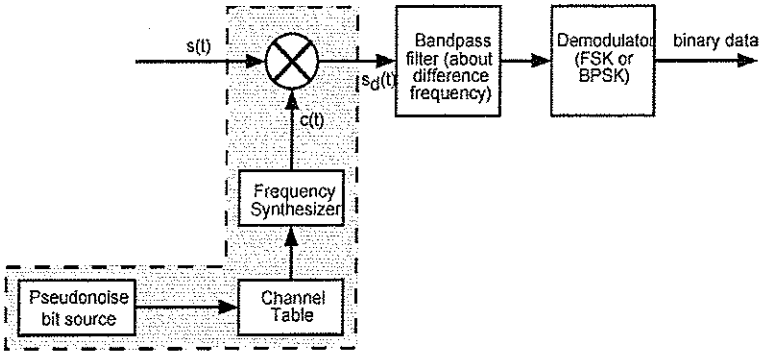
IV. What is the information data rate per user in half-rate cellular system?

9.

I. CDMA and TDMA are unique in the sense that each of the multiple access schemes is associated with a property for mitigating one of the fading degradation types. Against which type of degradation does each of these schemes provide a natural protection? **[4]**

II. Explain the following block diagram **[5]**





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IV YEAR EIE/EEE

Evaluation Component : **TEST-2[OPEN BOOK]**

EA C452 MOBILE TELECOMMUNICATION NETWORKS

Date : 15th May 2011 **Max. Marks: 40**

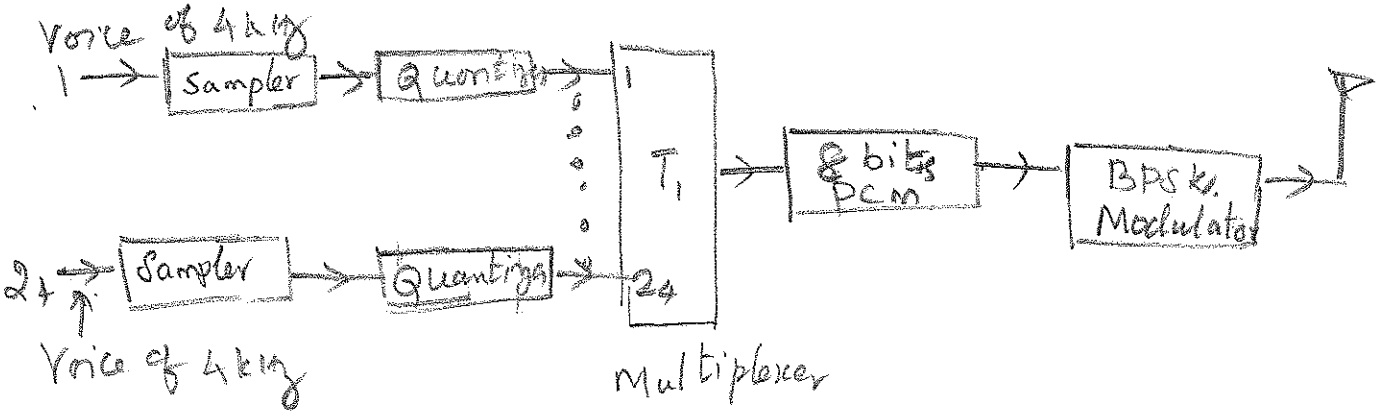
Duration: 50 mts **Weightage: 20%**

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

1. (i) 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. [4]
(ii) How to obtain 30 kHz bandwidth for AMPS standard . [4]

2. (i)Find out DPSK encoded bits and their phase if bits stream is 1101011001.List out the advantage of DPSK. [3]

(ii) Calculate bit rate of PCM-BPSK transmitter shown in figure given below [5]



(iii) Binary FSK has a probability of error in AWGN channel $P_e = \frac{1}{2}\exp(-\frac{E_b}{N_o})$ .Find out signal power required for transmission if Bit Error Rate (BER)is 10^{-3} ,if bit rate is 1000 bits/Sec. [4]

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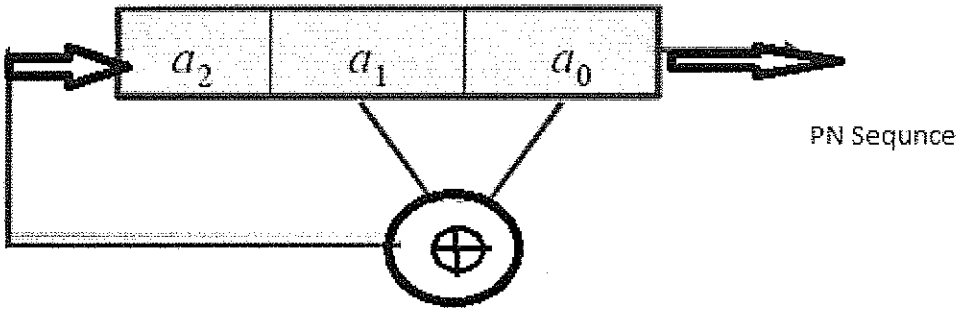
3. (i) DS-CDMA employs PN sequence generator given below. Find out the code and its length. Assume initial value of shift register as 000. [8]
   (ii) Find out coded bit stream when 1 is transmitted using this CDMA system [2]



4. (i)Draw TDMA frame structure .Find out frame efficiency if synchronization bits are 8 bits, ramp up bits are 8, control bits are 8, FEC bits are 32 and payload bits are 512.[4]

   (ii) Determine number analog channels per cell for the case of n=3 propagation path loss, where minimum acceptable C/I =14dB.What is the appropriate cluster size for the system. Assume the channel bandwidth is 30 kHz and the total spectrum allocation of 20MHz [6]

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Evaluation Component : **Test-1**

EA C452 MOBILE TELECOMMUNICATION NETWORKS

Date : 27th March 2011 **Max. Marks: 50**

Duration: 50 mts **Weightage: 25%**

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

1	(a) Derive the expression for S/I for N=7 cellular system (b) Develop your own algorithmic flow chart for Hand off process based on received power	[5] [5]
2	(a) Prove that Co-channel reuse ratio $q = \sqrt{3N}$. (b) What value of N is chosen for cellular communication ? Justify it	[5] [4]
3	A certain city has an area of 1300 square kilometer and is covered by a cellular system using 7 cell reuse pattern. Each has a radius of 4 km and the city is allocated 40 MHz of spectrum with a full duplex channel band width 60khz.Assume a GOS of 2% for an Erlang B system .If the offered traffic per user is .03 Erlang, calculate (i) number of cells in the service area (ii) number of channels per cell(iii) traffic intensity of each cell(iv) maximum carried traffic (v) total number of users can be served (vi) number of mobile users per channel(vii) maximum numbers of user served by system at a time.	[10]
4	If a transmitter produces 50 W of power ,(i) express the transmitted power in dBm.(ii) find received power in dBm at a distance of 100 Km when transmitter antenna of unit gain is employed at 900 MHz	[5]
5	A mobile having antenna gain of 0dB at 5 meter height is located at 5 km long distance receives 5.4×10^{-9} watts .Base site transmits 10 watts power through antenna with unity gain .Assume the Two ray model. Derive necessary expression for the base station antenna height and calculate the same.	[10]
6	Analyze Forward channel link design and reverse channel link design. Justify parameter for selection.	[6]

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Evaluation Component : **QUIZ-2**

EA C452 MOBILE TELECOMMUNICATION

Date : 18th April 2011 **Max. Marks: 14**

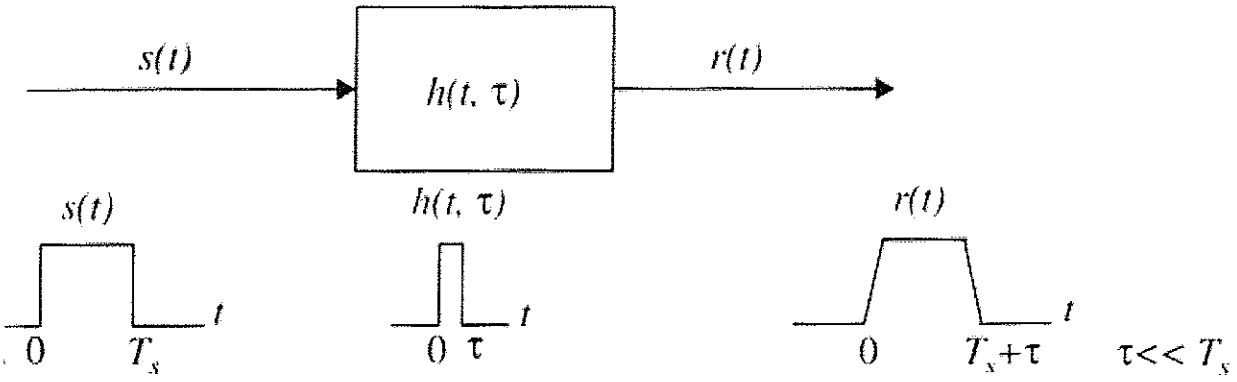
Duration: 20 mts **Weightage: 7%**

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

1. Determine the maximum and minimum spectral frequencies received from a stationary GSM transmitter that has a center frequency of exactly 1950MHz assuming that the receiver is travelling with a speed of 5km/hr and 100km/hr. [3]

2. Write factors influencing small scale fading in mobile communication.[1]

3. 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]



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4. What is ISI? Why does it occur in mobile communication environment? [2]

5. Compute the RMS delay spread for the following delay profile and estimate 90% correlation coherence bandwidth [3]

6. Doppler spread for the channel is 317 Hz. Compute the velocity of vehicle and coherence time if the base station transmits 1900 MHz [3]

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Evaluation Component : **QUIZ-I**

EA C452 MOBILE TELECOMMUNICATION

Date : 27th February 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 simplex 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. Why is PAGE control channel required for mobile communication.**[1 Marks]**

4. Define "Frequency reuse". Why is it required? .**[1 Marks]**

5. How much is the gap in terms of frequency between forward channel and reverse channel in AMPS.**[1 Marks]**

6. Draw channel details in the frequency spectrum from 824 MHz to 851 MHz **[2 Marks]**

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7. Find out the required value of S/I and distance D if K=7, q=4.6, γ=4 and radius of cell site is 500m..**[2 Marks]**

8. Calculate S/I for a mobile system having 6 cell sites in 1st tier at distance of D and 6 cell sites in 2nd tier at a distance 2D. **[2 Marks]**

9. Calculate number of radio channels required for a cell site if it has 28000 calls per cell per hour and each call has 1.76 minutes average calling time.[**[2 Marks]**

10. If a SIR 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 γ=3.Assume that there are six co-channels in the first tier and all of them are at same distance from mobile. Use suitable approximation. **[2 Marks]**