

BITS, Pilani- Dubai Campus
Knowledge Village, Dubai

I Semester (2004-2005)

Test-II

EA UC452 Mobile Telecommunication Networks

(Closed- Book)

Date: 24.11.2004

Duration: 90 mins .

Max.

Marks: 25

1. Explain the three basic propagation mechanisms. 3
2. What are flat fading, fast fading and slow fading? What are the conditions for the Above three types of fading? 3
3. Draw the diagram for multiple knife edge diffraction and the construction of the equivalent knife edge with comments. 1
4. What is Brewster angle? Give the expression for Brewster angle. If the Brewster angle for a wave impinging on ground is 32 deg. Find the relative permittivity. 1+1
5. A vehicle moving with a velocity of 40m/s toward the BS and the carrier frequency is 900MHz. Find the coherence time and the Doppler spread if the time correlation function is 0.9. The base band binary message has bit rate equal to 100kbps, modulated by BPSK. For the above case determine whether the channel is fast or slow fading. If the rms delay spread is 1.2microsecond, determine whether the signal is undergoes Flat fading or frequency selective fading. 6
6. Using PCS extension to Hata model, find the median path loss in urban area for the following parameters: frequency is 1.8 GHz, effective base and mobile antenna heights are 60m and 2m respectively and T-R separation is 5km. Consider a metropolitan center If the transmitted power is 50W, calculate the received power. 6
7. For a frequency of 900MHz, transmitter- obstacle distance of 7.5km, BS antenna height of 50m and mobile antenna height of 15m, find the loss due to knife-edge diffraction. If the Tx power is 45W, calculate the received power. 4

obstacle - receiver distance = 2.5 km, obstacle height = 150m

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QUIZ

EA UC452 Mobile Telecommunication Networks

Closed- Book

Date: 7.12.2004

Duration: 50min

Max.Marks:10

1. The effective isotropic radiated power (EIRP) is defined as
(a) $P_t G_t$ (b) $P_t G_r$ (c) $P_r G_t$ (d) $P_r G_r$
2. The free space propagation model is used to predict received signal strength when the transmitter and receiver have
(a) a clear unobstructed path between them (b) clear sky condition (c) heights comparable to obstacle height (d) none of the above
3. Reflection occurs when a propagating electromagnetic wave impinges upon an object which has very large
(a) transmitter power (b) dimensions compared to carrier wavelength (c) dimensions compared to T-R distance (d) all of the above
4. Brewster angle occurs
(a) only for parallel polarization (b) horizontal polarization (c) both parallel polarization (d) only when the first medium is free space
5. Diffraction is caused by the propagation of secondary wavelets into
(a) free space (b) a shadowed region (c) sharp objects (d) tall buildings
6. Path loss exponent n for free space is
(a) 4 (b) 3-5 (c) 2 (d) 4-6
7. For a vehicle moving directly toward the transmitter, the received carrier frequency is
(a) $f_c + f_d$ (b) $f_c - f_d$ (c) f_d (d) $f_d - f_c$
8. If a transmitted signal is able to resolve multipaths, then the average small-scale received power is simply the sum of the average powers received in
(a) two multipaths (b) each multipath (c) each multipath divided by the no. of multipaths (d) each multipath multiplied by each multipath
9. The maximum excess delay (X dB) defines the temporal extent of the multipath that is
(a) below a particular threshold (b) above a particular threshold (c) at the threshold (d) the average of two thresholds
10. The rms delay spread and the coherence bandwidth are
(a) directly proportional to each other (b) inversely proportional to each other (c) not (d) not a function of multipath structure

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 Comprehensive Examination
 EA UC452 Mobile Telecommunication Networks
 Date:03-01 2005 Duration: 3Hrs Max. Marks:40
 Part A (Closed-Book)

1. Between a pager, a cellular phone and a cordless phone, which device will have the longer battery life and why? Which device has the shortest battery life and why? 3
2. Determine the maximum raw instantaneous data rate that can be provided to a single user in EDGE assuming a single time slot on a GSM channel is available. 3
3. Explain how a cellular telephone call is made. 3
4. List the practical handoff considerations. 3
5. Explain the multipath shape factors with suitable expressions. 3

Part B (Open-Book)

1. A receiver in an urban cellular radio system detects a 1mW signal at $d = 2m$ from 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 if seven cell reuse pattern is used. What is the major radius if a four cell reuse pattern is used? 8
2. In the two ray path loss model with reflection coefficient (horizontal polarization) equal to -1, derive the appropriate expression for the location of the signal nulls at the receiver. 5
3. For the following digital wireless systems, estimate the maximum rms delay spread which no equalizer is required at the receiver (neglect channel coding antenna diversity or extremely low power level usage).

System	RF data rate	Modulation	
USDC	48.6kbps	$\pi/4$ DQPSK	
GSM	270.833kbps	GMSK	
DECT	1152kbps	GMSK	6

4. A 2 MHz carrier with an amplitude of 4V is frequency modulated by a modulating signal $m(t) = \sin(1000\pi t)$. The amplitude of the modulating signal is 2V and the peak frequency deviation was found to be 1KHz. If the amplitude and frequency of modulating signal are increased to 8V and 2KHz respectively, write an expression for the new modulated signal. 6

BITS, Pilani- Dubai Campus, Knowledge Village, Dubai
First Semester 2004-2005

Test I (Regular)

EA UC 452 Mobile Telecommunication Networks

Date: 26-09-2004 Duration: 50 min

Max. Marks: 15

(Open Book)

1. Assume a 1 AH battery is used on a cellular telephone. The cellular telephone draws 30 mA in idle mode and 200 mA during a call. How long would the phone work if the user leaves the phone continuously ON with (a) one call every 4 hours (b) one call every two hours? Each call has a duration of 3 minutes. Assume that the battery can be discharged only upto (a) 80% of its capacity and (b) 75% of its full capacity. 6
2. Compare the HSCD, GPRS and EDGE for 2.5 GSM, IS- 95B for 2.5G CDMA and IS-136 technology paths that each of the major 2G standards provide- which path has the highest internet access speed? Which technology is easier to implement in existing subscriber handsets? Which technology path involves high overall cost? 3
3. Determine the SIR on the forward link of a cellular system when the frequency reuse designs have $N= 1$, $N= 3$, $N= 4$ and $N= 7$ for $n=4$. Evaluate S/I contribution due to just first tier. Assume approximate geometry given in fig. 3.5 (text-book). 6