

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- VIIth SEMESTER-EXAMINATION – MAY/JUNE- 2012****Subject code: 171004****Date: 28/05/2012****Subject Name: Wireless Communication****Time: 02:30 pm – 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Differentiate between 2G-GSM and 3G-W-CDMA cellular wireless communication systems in terms of channel bandwidth, modulation technique and frame duration. **06**
- (b) Give complete classification of types of small-scale fading. **06**
- (c) Select the most appropriate option: **02**
- GSM cellular services uses
- A) FDMA for multiple channel access and FDMA for multiple users
B) FDMA for multiple channel access and TDMA for multiple users
C) TDMA for multiple channel access and FDMA for multiple users
D) TDMA for multiple channel access and TDMA for multiple users

- Q.2** (a) For a regular cellular structure with equal size hexagonal cells, show that $D/R = (21)^{1/2}$, Where D is the minimum distance between the centers of adjacent cells and R is the radius of each cell. Assume 7-cell reuse pattern. **07**
- (b) Determine the Signal-to-Interference (Co-channel) ratio for the system in Q.2 (a) in dB, assuming path loss exponent $n=4$. **07**
- For the same system, if, each cell is sectorized in 120° sectors, what will be the improvement in Signal-to-interference ratio compared to non-sectorized system, in dB?
- Also, determine adjacent channel interference for the same system.

OR

- (b) Define: Coherence Bandwidth (BW) and Coherence time. **07**
- Determine Coherence BW(90%) and Coherence BW (50%) for an rms delay spread of 8.47 ns
- Q.3** (a) Derive an expression for the received power for a two-ray reflection point to point mobile communication propagation model. Assume path loss exponent $n=4$. **08**
- (b) Answer following questions with respect to Wi-MAX technology: **06**
1. What is its full-form?
 2. Which multiple access method does it use?
 3. What is its approximate coverage range in km?
 4. What is the upper limit on data rate ?
 5. What is the range of radio channel bandwidth?
 6. Write two applications.

OR

- Q.3 (a)** Consider two different cellular systems that share the following characteristics. The frequency bands are 825-845 MHz for uplink and 870-890 MHz for the downlink. A duplex circuit consists of one 30 kHz channel in each direction. The systems are distinguished by the reuse factor, which are 4 and 19 respectively. For these systems, (i) Find the number of simultaneous communications that can be supported by a single cell in each system. (ii) Suppose that in each systems the cluster of cells (4,19) is duplicated 16 times, find the number of simultaneous communications that can be supported by each system. (iii) Suppose the average user makes 6 calls per 24 hours and mean call duration is 6 minutes, estimate the total number of users that can be supported by each system. (iv) If the billing for each customer is at the rate of 50 paisa/minute, determine average revenue per user (ARPU). **08**
- (b)** Calculate mean excess delay, rms delay spread and maximum excess delay (10 dB) for the multipath profile given in FIG.1. **06**

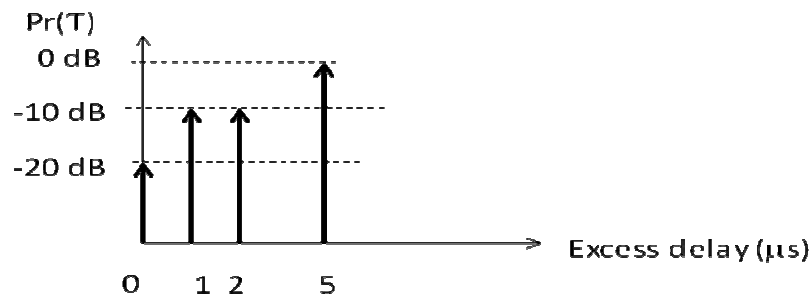


FIG.1

- Q.4 (a)** Explain the advantages of CDMA over GSM system in terms of Multipath characteristics, Privacy features, Security and Quality degradation. **08**
- (b)** Compare CDMA, FDMA and TDMA in terms of concept, key resources, sharing of resources, Bandwidth efficiency, system flexibility and system complexity **06**
- OR**
- Q.4 (a)** Draw frame format for a normal burst in GSM. Calculate gross bit rate/user/second, data rate/user/second and gross bit rate/physical channel for GSM system. **08**
- (b)** A cellular system has 32 cells; each cell has 1.6 km radius and the system reuse factor of 7. The system is to support 336 traffic channels in total. Determine the total geographical area covered, the number of traffic channels per cell and total number of simultaneous calls supported by this system. **06**
- Q.5 (a)** Find median path loss using Okumura's model for $d=50$ km $h_{te}=100$ m, $h_{re}=10$ m. If EIRP from base station is 1kW at 900 MHz, find received power. Take $A_{mu}(900 \text{ Mhz}(50 \text{ km}))=43$ dB and $G_{AREA}=9$ dB. **08**
- (b)** Explain the terms: 1. Hidden- terminal 2. Exposed –terminal **04**

- (c) Select the most appropriate option: 02
 The basic propagation mechanisms for radio waves are
 a) Radiation, Diffraction, Scattering b) Radiation, Attenuation, Scattering
 c) Reflection, Diffraction, Scattering d) Reflection, Diffraction, Radiation

OR

- Q.5 (a)** If a baseband binary message with a bit rate of 100 kbps is modulated by an RF carrier using BPSK, answer the following: 08

- a. Find the range of values required for the rms delay spread of the channel such that the received signal is a flat-fading signal b.
 If the carrier frequency is 5.8 GHz, what is the coherence time of the channel, assuming a vehicle speed of 30 miles/hr? c.
 For your answer in part b, is the channel “fast” or “slow” fading? d.
 Given your answer in part b, how many bits are sent while the channel appears “static”?

- (b) For knife-edge diffraction of FIG.2 show that the excess path length Δ is, 06
 $\Delta = h^2(d_1 + d_2)/2d_1d_2$, Where excess path length is the difference of direct line of sight path and indirect (diffracted) path between the transmitter and the receiver.

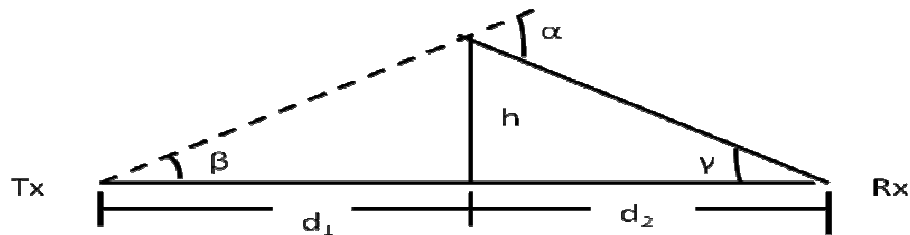


FIG.2

*** **