UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012

COURSE NAME	:	MOBILE RADIO COMMUNICATION
COURSE CODE	:	BEP 4273
PROGRAMME	:	BEE
EXAMINATION DATE	:	JUNE 2012
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER QUESTION IN **PART A** AND **THREE (3)** QUESTIONS IN **PART B.**

THIS PAPER CONSISTS OF **EIGHT** (8) PAGES

PART A (COMPULSORY QUESTION)

Q1 City BP has an area of 93.53 km^2 and is covered by a hexagonal cell Global System for Mobile Communication (GSM) network topology based on Frequency Division Multiple Access (FDMA) where each base station has transmitted signal, $P_r = 12\ W$, gain of the transmitter and receiver is $G_t = 15\ dB$ and $G_r = 10\ dB$ respectively. The network operates at 1800 MHz with system loss, $L = 2\ dB$. The minimum acceptable signal of the cellular network is $-39.8\ dBm$ assuming position at the boundary of two adjacent cells. (Hint : $2.5981R^2$)

(a) Given Grade of Service (GOS) of the given area is 2% and the traffic intensity per user, A_u is 0.01 E. As shown in Figure Q1;

(i) Calculate the size area of a cell.

(8 marks)

(ii) Assuming the city area covered by only one cluster, calculate the cluster size, N.

(3 marks)

(iii) If the traffic intensity of a cell, $A_{cell} = 7.5\ E$, calculate total number of user can be supported in BP area.

(4 marks)

(iv) Find the total allocated spectrum of the cellular network if 5% of the spectrum is allocated for control purpose.

(6 marks)

(b) Evaluate whether the designed network is capable of achieving market penetration of 50% if the population BP area is 15,000 residents? If not, propose possible strategy to increase the market penetration, the procedures should be taken and important considerations so the network performance is maintained.

(9 marks)

(c) If the FDMA cellular network is upgraded and combined with TDMA, calculate the maximum number of users can be supported in BP area. Discuss TWO (2) advantages and disadvantages of employing this upgrading.

(10 marks)

PART B

Q2 (a) A basic cellular system consists of mobile stations (MS), base stations (BS) and a mobile switching center (MSC). Illustrate the process involved between MS, BS and MSC before a communication link is established if the call is initiated by mobile station.

(6 marks)

(b) Okumura's model is one of the most widely used models for signal prediction in urban area. The model can be expressed as;

$$L_{50}(dB) = L_F + A_{m,u}(f,d) - G(h_{te}) - G(h_{re}) - G_{area}$$

Antenna tower of BS1, BS2 and BS3 are placed in different areas in District M which covers city area, village area and farm area as shown in Figure Q2(b). Assume these areas are very wide and covered by different cluster and all BSs radiates an EIRP of 1 *kW* at carrier frequency 950 *MHz*. The height of each BS and MS is 200 *m* and 3 *m* respectively. Consider for case where a MS is located at 2 *km* away from BS at all three different areas correspondingly

(i) Analyze the median path loss at the receiver in the THREE (3) different areas (assume a unity gain receiving antenna). Refer to Figure Q2(b)((i)-(ii)).

(10 marks)

(ii) Evaluate the answer in Q2(b)(i) loss in different type of environment based possible occurrence of multipath effect.

(4 marks)

Q3 (a) Demodulation is a process of extracting the baseband message from the carrier so that it may be processed and interpreted by the intended receiver. Differentiate between a coherent and non coherent detector by explaining the working principle of a demodulator with an aid of a diagram.

(10 marks)

(b) Due to Fading and multipath conditions in exist in the mobile radio channel, designing a modulation scheme that is resistant to mobile channel impairments is a challenging task. One of the strategies is to provide orthogonal modulation technique. Demonstrate how this is implemented in the contemporary applications with aid of constellation diagram.

(10 marks)

Q4 (a) The type of fading experience by a signal propagating through a mobile radio channel depends on the nature of the transmitted signal with respect to the characteristics of the channel. Investigate the effect of velocity of a mobile station to the Doppler shift in the operating frequency.

(4 marks)

(b) The local average power delay in a particular environment is found to be

$$P(\tau)=\sum_{n=0}^{n=2}\frac{2\times10^{-6}}{n^2+1}\delta\left(\tau-n10^{-6}\right)$$

(i) Sketch the Power Delay Profile (PDP) of the channel in *dBm*.

(4 marks)

(ii) Measure the rms delay spread of the channel.

(7 marks)

(iii) If 256 QAM modulation having a bit rate of 2 Mbps is applied to the channel, categorize the performance of the modulation in terms of having flat fading or frequency selective fading.

(5 marks)

Q5 (a) Explain the concept of Hybrid Spread Spectrum by differentiating the concept of Time Division Code Division Multiple Access (TDCDMA) with original CDMA and Time Division Frequency Hopping (TDFH) with original Frequency Hopping Multiple Access (FHMA).

(9 marks)

(b) The DECT system uses a 1.152 Mbps data rate to support twelve users per frame.

(i) Calculate the raw data rate provided for each user.

(2 marks)

(ii) If guard time, ramp-up time, and synchronization bits occupy 31.68 kbps, determine the traffic intensity for each user.

(4 marks)

(iii) Discuss potential combination of Frequency Division Duplexing (FDD) and Time Division Duplexing (TDD) with few Multiple Access techniques in order to provide narrowband and wideband communication system.

(5 marks)

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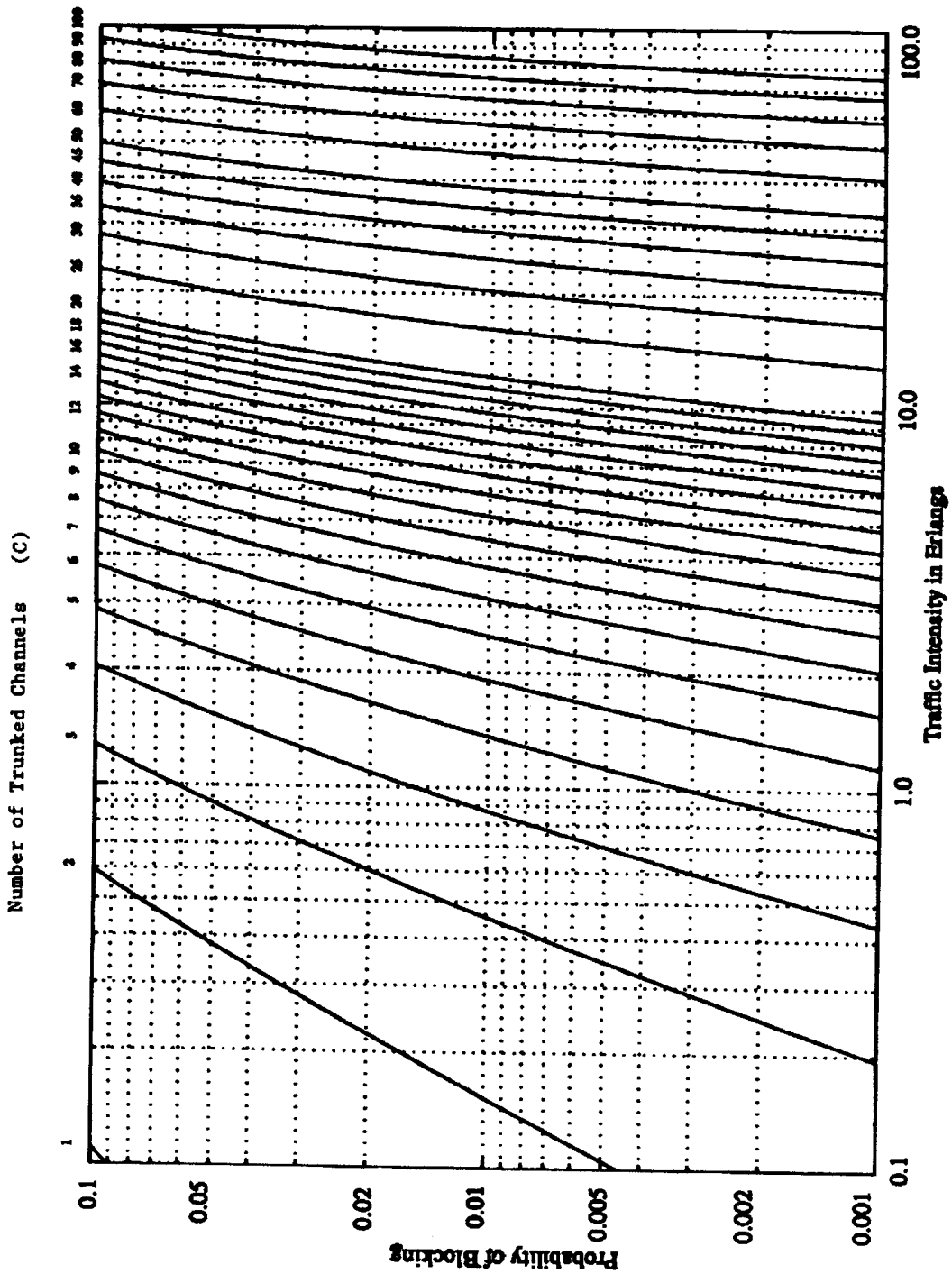

FIGURE Q1(a) : THE ERLANG B CHART

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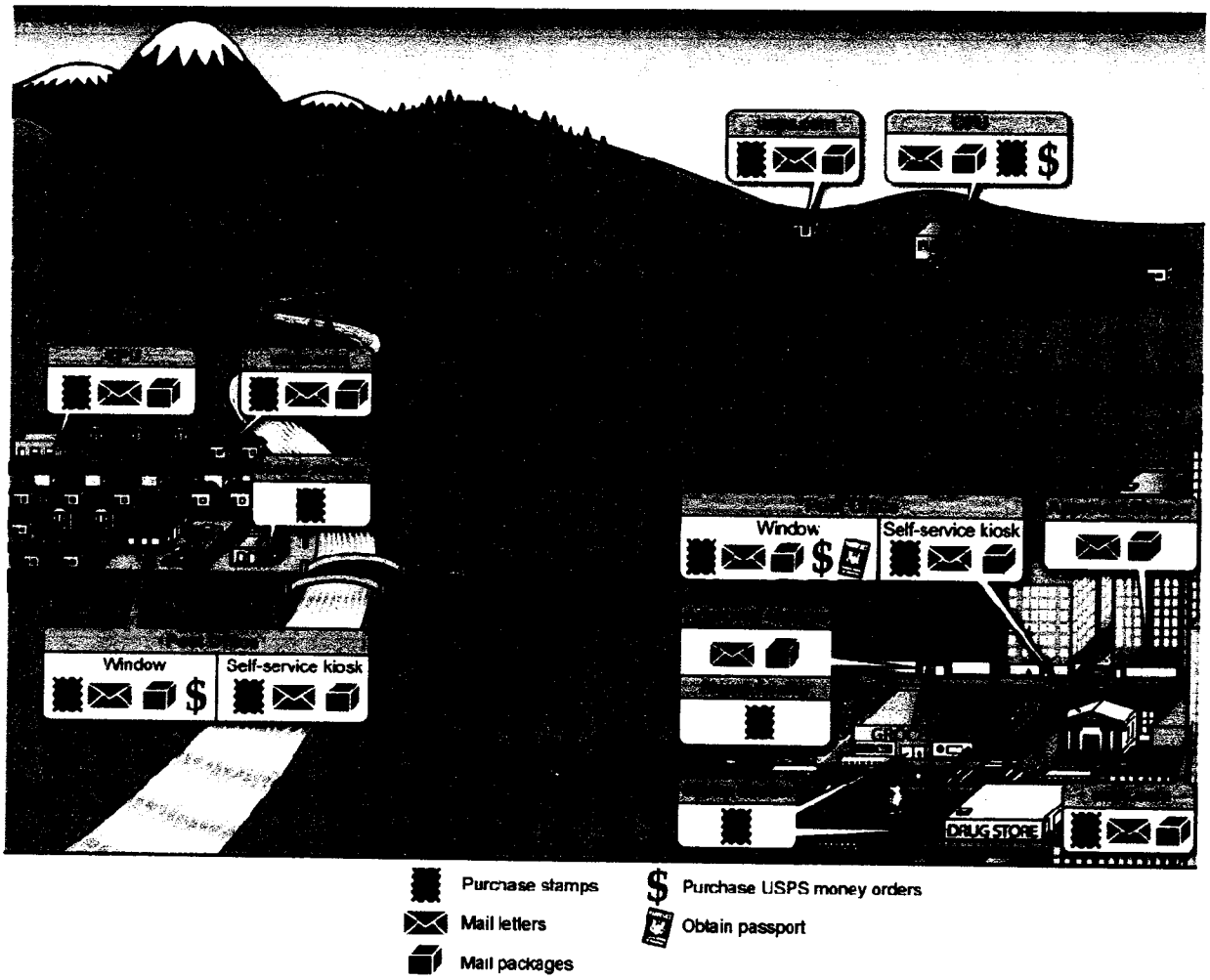

FIGURE Q2(b) : MAP OF DISTRICT M

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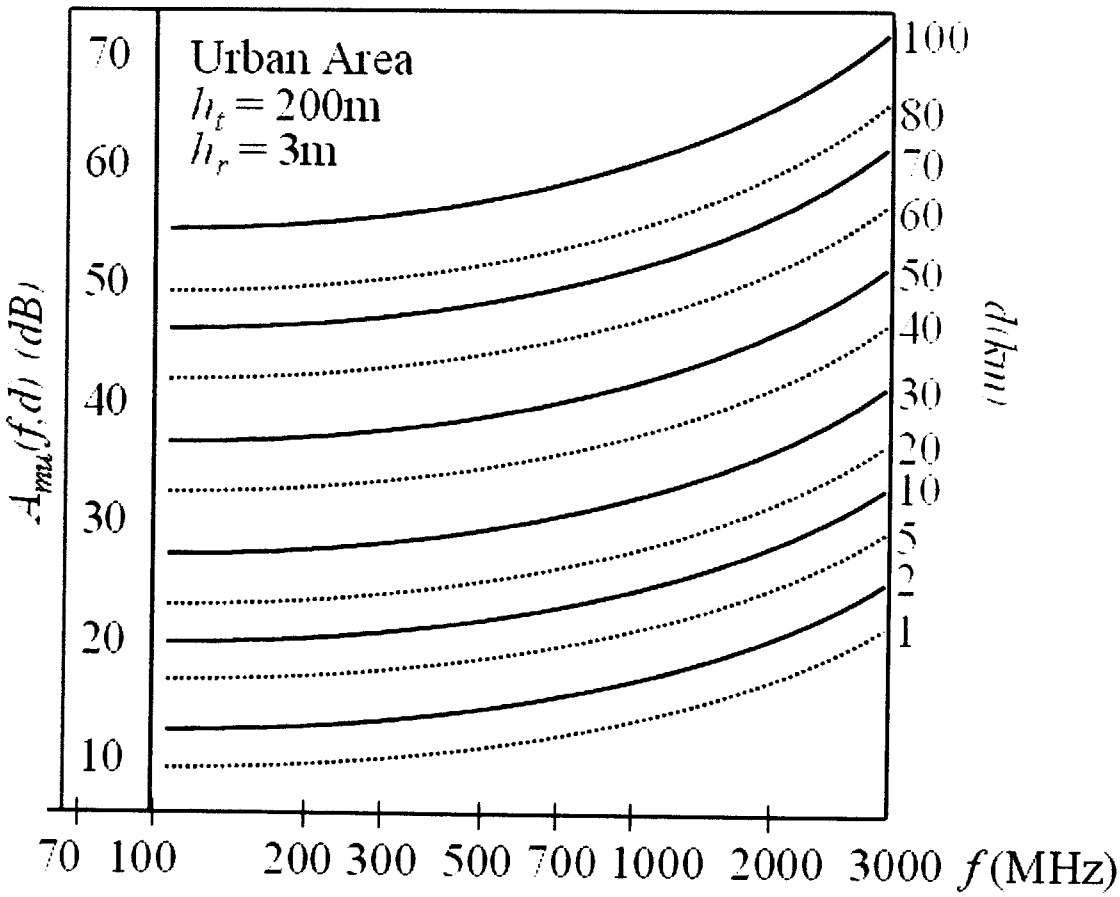

FIGURE Q2 (b)(i) : Media Attenuation Relative to Free Space

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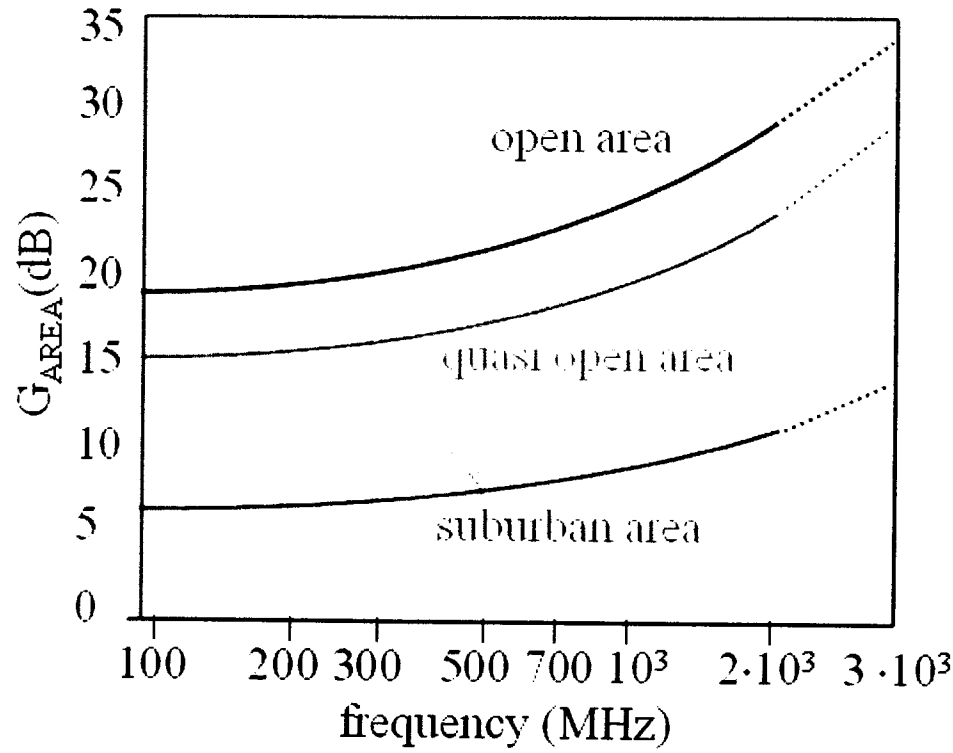

FIGURE Q2 (b)(ii) : Correction Factor for different type of terrain