Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME	:	WIRELESS AND MOBILE COMMUNICATION
COURSE CODE	:	BEB 41203
PROGRAMME	:	BACHELOR OF ELECTRONIC ENGINEERING WITH HONOURS
EXAMINATION DATE	:	DECEMBER 2015 / JANUARY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	SECTION A : ANSWER **ALL** QUESTIONS SECTION B : ANSWER **THREE (3)** QUESTIONS ONLY

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

SECTION A

Q1 Two cells in a cellular network is shown in **Figure Q1.** A mobile station near BS1 is moving along a straight line to BS2. The cellular system employs Ground 2-Ray Reflection Model to provide better prediction on the received signal power based on the line of sight (LOS) and ground reflected path (NLOS). The model prediction is based on d, the distance of the mobile station (MS) from the base station (BS), the height of BS, h_t and MS, h_r.

(a) Prove that the path loss, PL(dB) is given as:

$$PL(dB) = 120 + 40\log d(km) - 20\log h_t(m) - 20\log h_r(m)$$

(5 marks)

(b) Assuming the reflection and scattering effects are negligible, calculate the threshold level, $P_{r,HO}$ used for handoff initiation by MS at point A. The effective isotropic radiated power (EIRP) is -20 dBm and the gain of the antenna at MS is 8 dB.

(5 marks)

(c) The minimum acceptable signal level at MS, $P_{r,min}$ is -98 dBm. Calculate:

(i) the minimum required margin $\Delta = P_{r,HO} - P_{r,min}$.

(ii) If the time required to complete a handoff, Δ is 1 ms, determine the maximum speed of the MS that can be handled by the MSC to complete a handoff.

(5 marks)

(d) Predict what will happen to the conversation if the speed of the MS is 100 km/hr. Give your justification and propose **TWO (2)** suggestions to provide better communication system.

(6 marks)

(e) Explain the condition where the unnecessary handoff occurs and how this will reduce the efficiency of the cellular network.

(4 marks)

SECTION B

Q2 **Figure Q2(a)** shows a technique used to increase the number of mobile communication channel in a particular area.

(a) Discuss the need to have different cell size in a local network topology as illustrated in **Figure Q2(a)**. Explain the design strategy of the chosen reason.

(9 marks)

(b) The cell topology in **Figure Q2(a)** is refering to one cluster with the Grade of Services (GOS) of 2%. Calculate;

(i) the total traffic intensity in the cluster,

(4 marks)

(ii) the total number of user can be supported by the network if the traffic intensity per user Au = 0.01,

(3 marks)

(iii) the total spectrum available to the customers, and

(5 marks)

(iv) the number of users that can be served simultaneously considering one radio channel is divided into eight time slots.

(4 marks)

Q3 (a) A binary spread spectrum sliding correlator multipath measurement system has the following parameters:

Transmitter chip period = 100 ns
PN sequence length = 1023

(i) Find the time between maximal correlation and the slide factor if the receiver uses a PN sequence clock 60 kHz slower than the transmitter.

(3 marks)

(ii) Assuming that two successive maximal correlation peaks are to be displayed on the oscilloscope for one complete cycle of the PN sequence. If 10 divisions are provided on the oscilloscope time axis, determine the most appropriate sweep setting (in seconds/division) to be used.

(2 marks)

(iii) Determine the required IF passband bandwidth for the system. By using similar time resolution, compare the bandwidth with a direct pulse system.

(5 marks)

(iv) Propose a method to improve direct pulse system in part (a)(iii).

(3 marks)

(b) **Figure Q3(b)** shows the evolution of wireless cellular standard. Discuss the evolution of the cellular protocol's available features by referring to similarity and advancement of its generation.

(8 marks)

(c) Define simplex communication. Briefly explain the working principle of simplex communication by choosing **ONE (1)** example of wireless communication system.

(4 marks)

Q4 (a) Explain Code Division Multiple Access (CDMA) using suitable diagram.

(6 marks)

(b) Explain the occurrence of near-far problem in CDMA and techniques to address the problem.

(6 marks)

(c) In an omni-directional CDMA cellular system with single-cell and single-sector antenna, a minimum E_b/N_0 of 18.5 dB is required for each user. If 280 users with a baseband data rate of 13 kbps are to be accommodated, determine the minimum channel bit rate of the spread spectrum chip sequence:

(i) when voice activity is ignored, and
(ii) when voice activity is considered and is equal to 40%.

(6 marks)

(d) Suggest a technique to increase the CDMA capacity in part (c).

(7 marks)

Q5 (a) State FOUR (4) differences between Slow Associated Control Channel (SACCH) and Fast Associated Control Channel (FACCH).

(8 marks)

(b) Draw the allocation of bits in a United State Digital Cellular (USDC) TDMA half-rate time slot from mobile to base station. Then, determine:

(i) the air interface channel data rate,
(ii) the time duration for each slot,
(iii) the number of symbols per frame, and
(iv) the frame efficiency.

(10 marks)

(c) Explain how United State Digital Cellular (USDC) maintain compatibility with the existing Advanced Mobile Phone System (AMPS) cellular phones.

(7 marks)

- END OF QUESTIONS -

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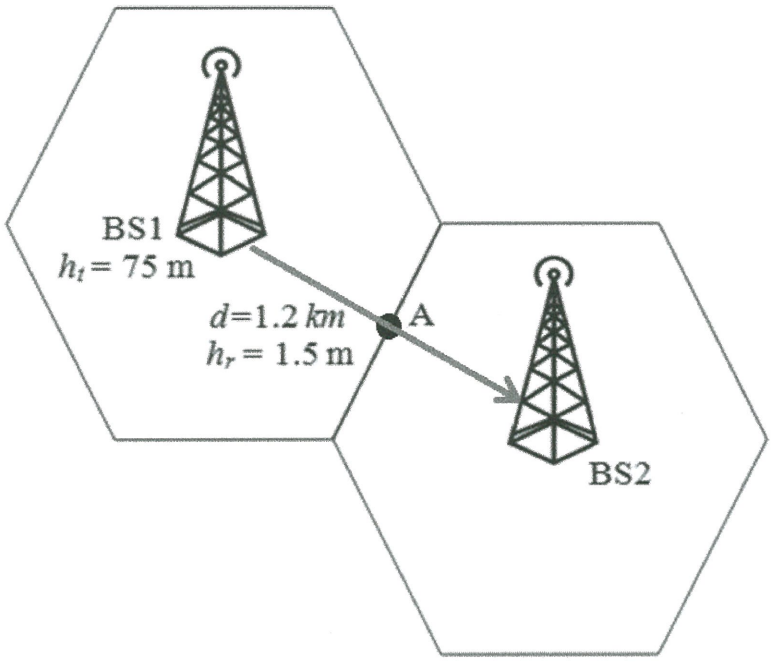

FIGURE Q1

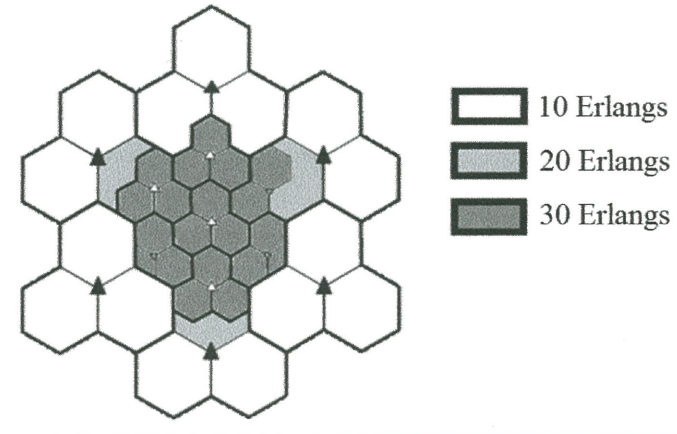

FIGURE Q2(a)

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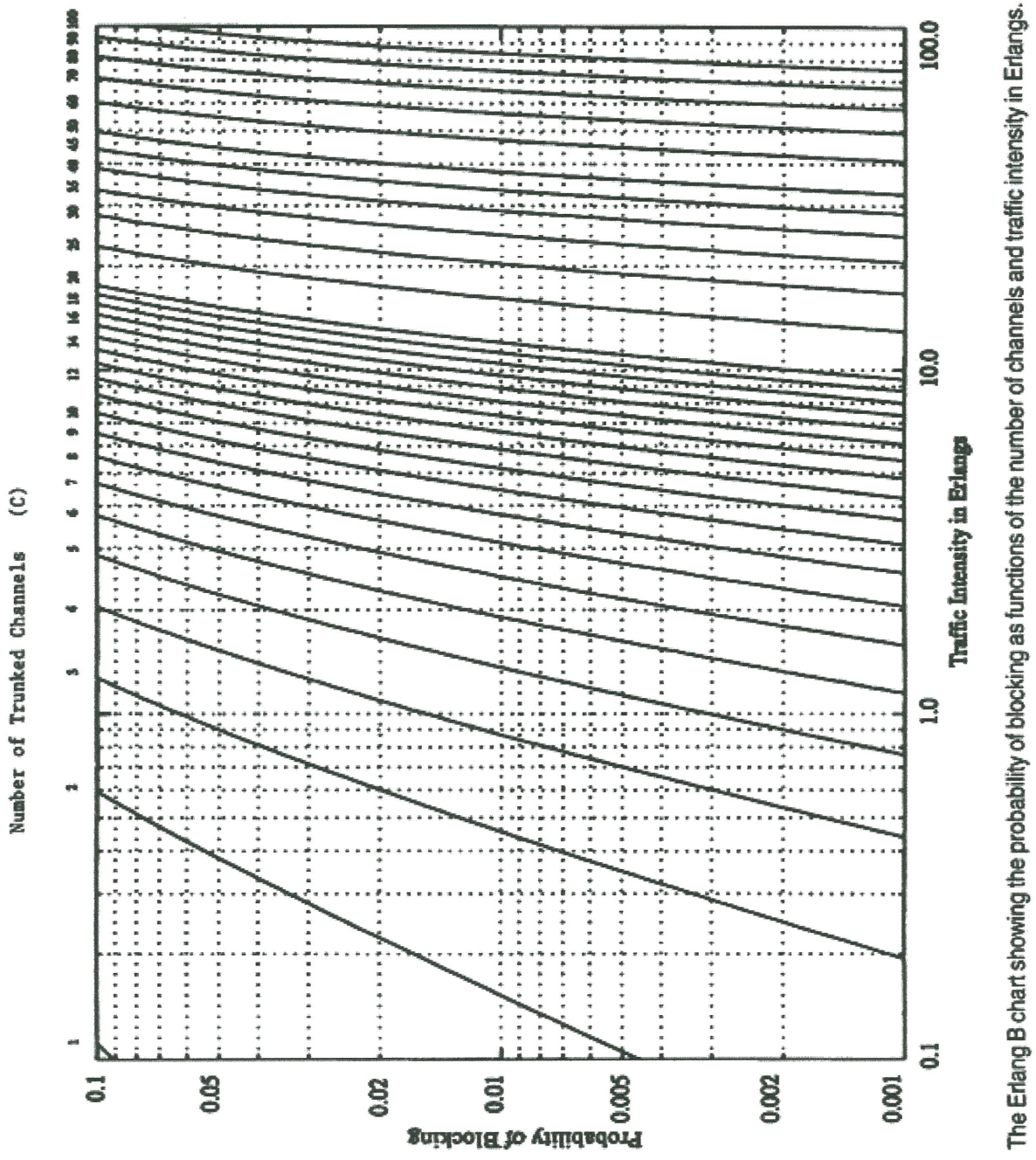

FIGURE Q2(b)

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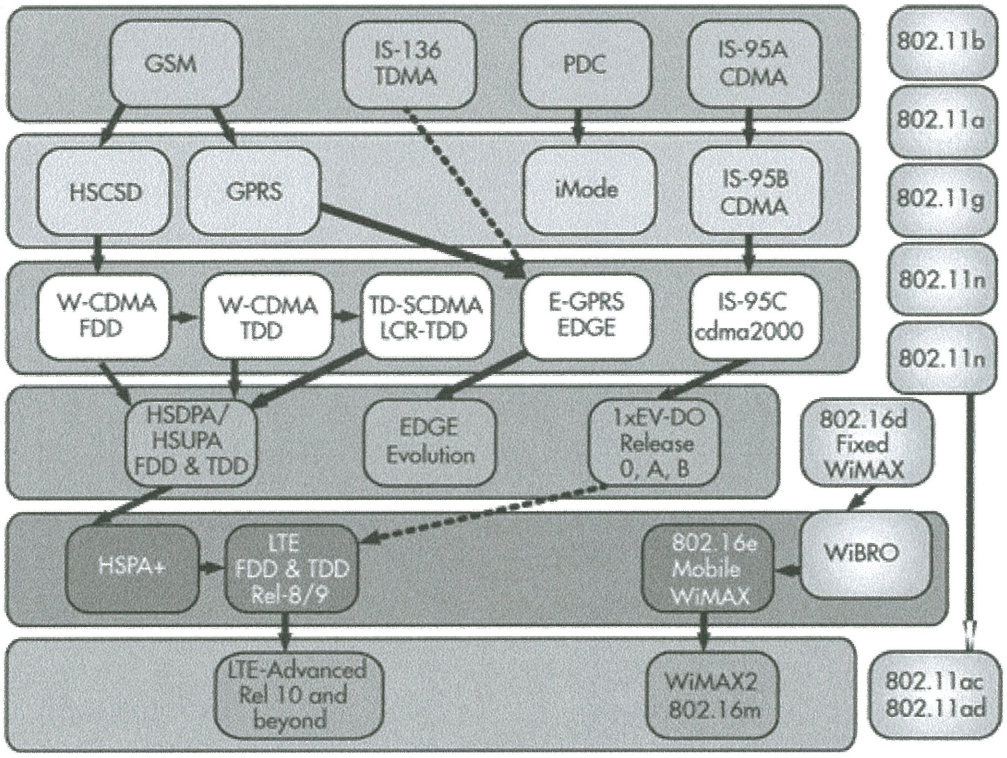

FIGURE Q3(b)