UNIVERSITY OF GHANA

MSc/MPhil FIRST SEMESTER UNIVERSITY EXAMINATIONS: 2015/2016

DEPARTMENT OF COMPUTER SCIENCE

CSCD - 609 Principles of Mobile and Wireless Systems

(3 CREDITS)

EXAMINER: F.A. Katsriku

TIME ALLOWED: 3HOURS

Answer Question ONE and any other THREE questions

Answer Q1 and any other THREE Questions. All questions carry equal marks

Q1

The questions here are based on the paper you were given by **V. Erceg & al. "An Empirically Based Path Loss Model for Wireless Channels in Suburban Environments", in** *IEEE Journal on Selected Areas in Communications*, **Vol. 17, No 7, July 1999.** Using this paper as a reference, answer the following questions:

 a) Summarize data collection campaign methods and size. [5 marks]
 b) Summarize the key findings of this paper. [5 marks]
 c) A key finding is that path loss exponent variations are Gaussian, how is that proven in the paper? [5 marks]
 d) Write short comments on the following 3models: Free space, COST 231-Hata, & Erceg model proposed in the paper. [10 marks]

Q2

a) With the aid of suitable examples clearly explain the need for modulation [10 marks]

b) Given a carrier signal

$$v_c = V_c \sin 2\pi f_c t$$

and an information signal

$$v_s = V_s \sin 2\pi f_s t$$

Show that the modulated wave in an amplitude modulated system is given by

$$v = V_c \sin 2\pi f_c t + \frac{m}{2} V_c \cos 2\pi (f_c + f_s) t - \frac{m}{2} V_c \cos 2\pi (f_c - f_s) t \qquad \text{[10 marks]}$$

c) For the amplitude modulated wave given in part b) above, show that the total transmitted power is given by

$$P_T = P_c \left(1 + \frac{m^2}{2} \right)$$

[5 marks]

Q3

 a) You have just arrived in a foreign country and switched on your phone. With the aid of a suitable diagram, describe the process of registration of your mobile handset that will enable you to place call. [5 marks]
 b) Explain the concept of mobility management. Your answer should focus on the three aspects of location management as well as the main issues. [5 marks]
 c) Discuss the two classes of location update algorithms. Under what circumstances is a location update done in GSM systems? [15 marks]

Q4

a) What are the disadvantages of using wireline TCP over wireless networks?   [5 marks]

b) Provide a detailed discussion on how the performance of TCP/IP might be improved over wireless networks. Your answer should include a discussion of the following:

The split connection approach

The fast re-transmission approach

The link leveler-transmission approach

The use of snoop protocol   [20 marks]

Q5

a) Use an example to explain the key issue in contention based access protocols and how can it be resolved explain   [5 marks]

b) How does slotted ALOHA improve on throughput as compared to pure ALOHA   [5 marks]

c) Explain whether or not it is practical for mobile stations to use ALOHA or slotted ALOHA for access to a control channel associated with a base station   [5 marks]

d) Describe the advantages and disadvantages of persistent and non-persistent CSMA protocols. Under what condition would use each of them?   [10 marks]

Q6

a) Briefly describe the makeup of the ionosphere and its effect on radio waves   [4 marks].

b) With the help of diagrams describe three basic modes whereby an electromagnetic wave propagates from a transmitting to a receiving antenna.   [9marks]

c)

i.   Explain the term radio horizon.   [1 marks]

ii.   Given that the radius of the earth is 6400km obtain a relation for the radio horizon making clear any assumptions.   [6marks]

d) A new TV station intends to reach customers up to a distance of 50Km, how tall should the antenna be? What difference would it make if it is known that the highest possible tower in their area is 400m and that viewers use antennas on their roof tops. Assume a roof height of 3meters and an antenna height of 1 meter.   [5marks]