CARLETON UNIVERSITY

Department of Systems and Computer Engineering

SYSC4700 Telecommunications Engineering Winter 2011

Term Exam – 18 February 2011

Duration: 80 minutes

Instructions:

1. **Closed-book exam (no aid-sheet). Use of non-programmable, non-communicating calculators is permitted.**
2. **Write answers in the spaces provided on the question sheet.**
3. **If necessary, use both sides of a page.**
4. **Write legibly, and state any assumptions that you make.**

Name:

Student Number:

E-mail:

Question	Mark	Max possible mark
1		18
2		39
3		30
4		25
Total		112

Question 1 [18 points] – Acronyms

What do the following acronyms stand for?

(a) MPLS:

(b) FDMA:

(c) POTS:

(d) CDMA:

(e) VoIP:

(f) ATM:

Question 2 [36 marks] – Short Questions

(a) [6 pts] The **smart grid** is the fusion of ---------- and ----------

with the ---------- grid.

(b) [6 pts] Write two benefits of **smart grid**:

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(c) [6 pts] In the 7-layer OSI model, what are the names of the following layers (for instance, Layer 4 is the “transport layer”):

* Layer 1:

* Layer 2:

* Layer 3:

(d) [6 pts] Give three reasons why businesses prefer IP over TDM:

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(e) [3 pts] What is the most common signaling protocol for VoIP?

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(f) [6 pts] What is the main cause of the delay in VoIP networks which does not exist in the conventional wired telephone networks (which are TDM based)?

(g) [6 pts] What are the three steps in pulse code modulation (PCM)?

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Question 3 [30 marks] – Power Calculations in Wireless Communications

Consider two cellular base stations denoted as BS_A and BS_B. The following simple propagation model relates the received power P_r to the transmit power P_t in the given environment:

$$P_r = P_t\left(\frac{\lambda}{4\pi}\right)^2\left(\frac{1}{d}\right)^{3.5}.$$

In the above, λ is the carrier wavelength and d is the distance.

The propagation parameters for both BSs are the same, except for the transmit powers; BS_A transmit power is 5 dB higher than BS_B transmit power.

Consider a wireless terminal moving from BS_A towards BS_B on a straight line. In the beginning the terminal receives its signal from BS_A; the terminal switches to BS_B when the received signal power from BS_B exceeds that from BS_A (this process is called “handoff” or “handover”).

If BS_A and BS_B are 1,500 meters apart, determine at what point the handoff will occur.

Question 4 [25 marks] – High Quality Audio through Wireless

Linear pulse-code modulation (LPCM) is a method of analog-to-digital conversion (ADC). LPCM is PCM with linear quantization (rather than quantizing the amplitude of the sampled audio in the logarithmic scale which is used in telephone networks, as discussed in class). LPCM is used in many standards including DVD and Blu-ray.

a) Find the bit rate for LPCM audio on DVD with the following specifications:

- 65536-level quantizer
- 48 KHz sampling rate
- 8 channels (7.1 surround sound)

b) If a digital audio signal formatted according to the above LPCM specifications is sent through a wireless channel using 16-ary QAM modulation, find the required bandwidth.