YOUR NAME:_____
(Please underline your family name)
STUDENT NUMBER:_____

SYSC 4700 TELECOMMUNICATIONS ENGINEERING

Instructions:

(1) **DO QUESTION 1 PLUS <u>ANY FIVE</u> OF THE REMAINING NINE QUESTIONS. All questions carry equal weight. <u>If more than a total of 6 questions are attempted, indicate which 6 you wish to be marked. Otherwise, only the first 6 will be marked (including question 1).</u>**

(2) **Read the questions carefully, and state any assumptions necessary. Write your answers clearly, using the spaces provided on the examination paper. If necessary, you may use the reverse (blank) side of any page, or the blank pages at the end, to write answers or do rough work. Questions may be answered in point form, or in short essay form.**

There are 19 pages, including 4 blank pages, and an Erlang B table at the end.

	Question	Mark	Out of
<u>Do question1</u>	**1**		**12**
<u>Do only 5 out of</u> **<u>Questions 2-10</u>**	**2**		**12**
	3		**12**
	4		**12**
	5		**12**
	6		**12**
	7		**12**
	8		**12**
	9		**12**
	10		**12**
	Total		**72**

Question 1

Describe the purpose and operation of any three of the following (if necessary, draw diagrams):

(a) Hybrid

(b) digital time switch (time slot interchange)

(c) router

Questio 1 (cont.)

(d) signal transfer point in CCS7

(e) public key cryptography

Question 2

(a) Define and describe TDMA (time division multiple access).

(b) Define and describe CDMA (code division multiple access)

(c) Explain how the reuse of frequencies among cells differs between cellular systems that use TDM and those that use CDMA.

Question 3

(a) Define and illustrate plesiochronous synchronism in telecommunications networks.

(b) Describe a controlled slip, and how it is implemented with a buffer.

Question 4

A suburban neighbourhood contains 1000 voice telephone subscribers. During the busy hour, each is using their telephone 10% of the time, on the average. The maximum blocking probability for the voice telephone subscribers is to be 1%. The same neighbourhood has 100 high speed internet users (assumed distinct and independent of the voice users). On the average, half of these internet users are active during the busy hour, and the bit rate to and from each active user is 1 Mb/s. The blocking probability of these users is to be no more than 5%. Calculate the total bit rate needed in each direction to transport the voice and data traffic in this neighbourhood. Express your answer in Megabits per second and also in terms of number of digital multiplex facilities needed (DS1's or DS3's or SONET OC1's or…).

Question 5

(a) Explain how a DS1 signal is transported within a SONET frame.

(b) Explain how a unidirectional SONET ring handles a break in the ring.

(c) Explain how resilient packet rings (RPR) differ from SONET rings, in terms of how they work, their efficiency, and how they handle breaks.

Question 6

Describe and compare the following high speed digital subscriber access technologies:
(i) DSL (digital subscriber line)
(ii) PON (passive optical network),
as follows:

(a) Their technologies (what they consist of and how they work)

(b) Their relative costs of installation and operation.

(c) Their abilities to deliver high bit rates to and from subscribers.

Question 7

Summarize the characteristics and differences among the following packet switching technologies, according to the headings given for each:

(a) X.25

Typical speed and type of application:

Routing:

Packet size:

Control of errors and quality of service:

(b) Frame relay

Typical speed and type of application:

Routing:

Packet size:

Control of errors and quality of service:

Question 7 (cont.)

(c) ATM

Typical speed and type of application:

Routing:

Packet size:

Control of errors and quality of service:

(d) TCP/IP

Typical speed and type of application:

Routing:

Packet size:

Control of errors and quality of service:

Question 8

(a) Outline the business case for VOIP (voice over internet protocol)

(b) Outline the technology challenges for implementing VOIP.

Question 9

(a) Describe the value of telecommunications standards for:

(i) Service providers (like Bell Canada, Telus, Rogers,..)

(ii) Vendors (like Nortel, Cisco,…)

(iii) Customers (like you, the university,…)

(b) List three recent important telecommunications standards

(c) Briefly describe each of the following 3 types of standards bodies, and give one example of each:

(i) Accredited

(ii) Treaty-based

(iii) Forums or consortia.

Question 10

(a) Explain the difference between government policy-making and regulation in the telecommunications industry, illustrating your answer with a Canadian example or examples.

(b) Give two examples of regulatory and/or policy changes in the Canadian telecommunications industry since 1990.

(c) Select one of these examples, and describe its consequences.

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