THE UNIVERSITY OF BRITISH COLUMBIA Department of Electrical and Computer Engineering EECE 251– Circuit Analysis I (Section 103) Final Exam Thursday December 15th, 2011 Time: 150 minutes

You can use a formula sheet for this exam and <u>calculators</u> are allowed. Please attempt to answer all problems. A blank sheet will not receive any marks!

Good luck!

READ THIS

This examination consists of 5 questions and 11 pages (including the cover page). Please check that you have a complete copy. You may use both sides of each sheet if needed.

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		H H	MAX	GRADE
		1	20	
Surname	First name	2	20	
		3	20	
		4	20	
Student Number		5	20	
		TOTAL	100	

IMPORTANT NOTE: The announcement "stop writing" will be made at the end of the examination. Anyone writing after this announcement will receive a score of 0. No exceptions, no excuses.

All writings must be on this booklet. The blank sides on the reverse of each page may also be used.

Each candidate should be prepared to produce, upon request, his/her Library/AMS card.

Read and observe the following rules:

No candidate shall be permitted to enter the examination room after the expiration of one-half hour, or to leave during the first half-hour of the examination.

Candidates are not permitted to ask questions of the invigilators, except in cases of supposed errors or ambiguities in examination-questions.

Caution - Candidates guilty of any of the following, or similar, dishonest practices shall be immediately dismissed from the examination and shall be liable to disciplinary action:

Making use of any books, papers or memoranda, calculators, audio or visual cassette players or other memory aid devices, other than as authorized by the examiners.

Speaking or communicating with other candidates.

Purposely exposing written papers to the view of other candidates.

The plea of accident or forgetfulness shall not be received.

1

1. Use the analysis technique of your choice to find the power (consumed or delivered) by the **independent sources** and **resistors** R_2 and R_4 . [20 marks]



2. The circuit in the Black Box is a linear circuit. When $R_L = 4k\Omega$, the load current is 2mA, that is, $i_L = 2mA$ and when $R_L = 12k\Omega$ then $i_L = 1mA$.



- a) Find R_L to which the maximum power is transferred from the Black Box. $\left[14 \text{ marks} \right]$
- b) What is the amount of maximum power in part a. [6 marks]

3. In the following circuit, the switch has been open for a long time and it closes at t=0. Find the current i(t) (i.e., the current of 1Ω resistor) for t>0. [20 marks]



4. In the following circuit, assume opamps are ideal and the voltage across the capacitor at time t=0 is 0V (that is, the capacitor is discharged). The input sources are in volts and u(t) is the unit step function.



- a) Find V_{out}(t) for t≥0.[14 marks]
- **b**) What is the minimum required V_{DD} and maximum required V_{SS} (V_{DD} and V_{SS} are positive and negative supply voltages of both opamps) such that the two opamp outputs are not saturated. **[6 marks]**

5. As discussed in class, the simplest model of a real diode consists of a voltage source in series with an ideal diode. That is when the diode is on it acts like a voltage source and when it is off it acts like an open circuit. Using this model, in the following circuit, find the **diode current I_D** and **the current "i" through resistor R₁.** (Note that the diode is a silicon diode, i.e., when the diode is on the voltage drop across it is 0.7V.) [20 marks]

