University of Toronto
Faculty of Applied Science and Engineering
Department of Electrical and Computer Engineering

ECE110S – Electrical Fundamentals
Midterm Test 1 – February 12, 2009, 6:00 – 7:00 p.m.

($e = 1.6 \times 10^{-19}$ C, $\varepsilon_0 = 8.85 \times 10^{-12}$ F/m, $\mu_0 = 4\pi \times 10^{-7}$ H/m, g = 9.81N/kg)

ANSWER ALL QUESTIONS ON THESE SHEETS, USING THE BACK SIDE IF NECESSARY.

1. Non-programmable calculators are allowed.
2. For full marks, you must show methods, state UNITS and compute numerical answers when requested.
3. Write in PEN. Otherwise, no remarking request will be accepted.
4. There is one extra blank page at the end for rough work.

Last Name:

First Name:

Student Number:

Tutorial Section:

01	WB130	Mon. 3-5 p.m.
02	GB404	Mon. 3-5 p.m.
03	SF3201	Tue. 4-6 p.m.
04	GB405	Tue. 4-6 p.m.
05	GB404	Wed. 4-6 p.m.
06	GB412	Wed. 4-6 p.m.
07	GB404	Wed. 2-4 p.m.
08	GB412	Wed. 2-4 p.m.
09	SF2202	Fri. 4-6 p.m.
10	GB304	Fri. 4-6 p.m.
11	SF3201	Fri. 2-4 p.m.
12	GB412	Fri. 2-4 p.m.

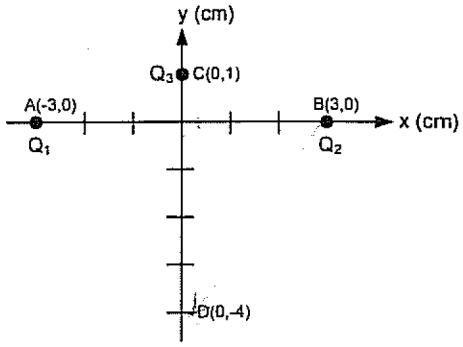
Question	Mark
1	
2	
3	
TOTAL	

1. [10 marks] Three point charges Q_1=2nC, Q_2=2nC, and Q_3 are located in a Cartesian coordinate system at A(-3cm, 0), B(3cm, 0) and C(0, 1cm) respectively, as shown below

(a) Calculate the charge Q_3 so that the total electrostatic force exerted on an electron placed at point D(0, -4cm) is equal to zero. **(6 marks)**

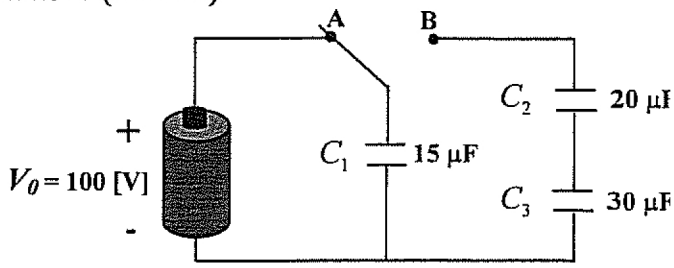
(b) Calculate the electric potential V_D, at point D due to the charges Q_1, Q_2 and Q_3. **(3 marks)**

(c) Calculate the electric field E_D, at point D due to the charges Q_1, Q_2 and Q_3. **(1 mark)**



2. [10 marks] Initially the switch is in position A and capacitors C_2 and C_3 are uncharged. Then the switch is flipped to position B. Afterwards

(a) What is the potential difference across C_1? **(3 marks)**
(b) What is the potential difference across C_2 and C_3 combination? **(1 mark)**
(c) What is the charge on C_1? **(1 mark)**
(d) What is the charge on C_2? **(2 marks)**
(e) What is the charge on C_3? **(1 mark)**
(f) What is the potential difference across C_2? **(1 mark)**
(g) What is the potential difference across C_3? **(1 mark)**



3. [10 marks] A positively charged particle is moving with a constant velocity $\boldsymbol{v} = 2.0\times10^4$ m/s $\hat{\mathbf{j}}$ in a uniform electric field $\mathbf{E} = 2.0$ V/m $\hat{\mathbf{i}}$. A long current-carrying wire is parallel to the y-axis and is separated from the charge by 1.0 cm, as shown in the figure below. Find:

(a) The direction of the current in the wire. **(2 marks)**
(b) The magnitude of the current in the wire. **(5 marks)**
(c) If the current is reduced by half, in order to maintain the straight trajectory of the charged particle, what should the velocity of the charged particle be? **(3 marks)**