DUBLIN CITY UNIVERSITY

August 2005

COURSE:	APPLIED PHYSICS PHYSICS and ASTRONOMY
YEAR:	2
SEMESTER	1
EXAMINATION:	PS203: Electronics 1
EXAMINER:	Dr B. Lawless (5300)
DURATION:	2 hours
INSTRUCTIONS:	Answer 5 parts of Question 1 (50 %) and 2 other questions (25 % each) Do not turn over this page until instructed to do so.
NUMBER OF PAGES	8 (including this cover page.)

Question 1. Answer five parts of this question.

(a) In the circuit shown in Figure 1, a voltage of 2.9V is measured between node B and Ground. Calculate the current in the circuit. Calculate the voltage between node A and Ground.

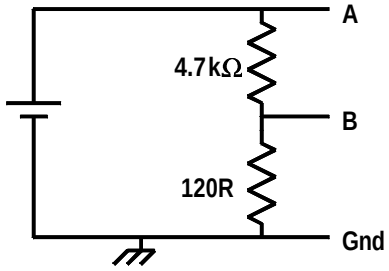

Figure 1: Question 1 (a)

(b) The waveform shown in Figure 2 is observed on an oscilloscope with the timebase set to 2ms per division and the Y amplifier set to 5V per division. Obtain the equation for the waveform.

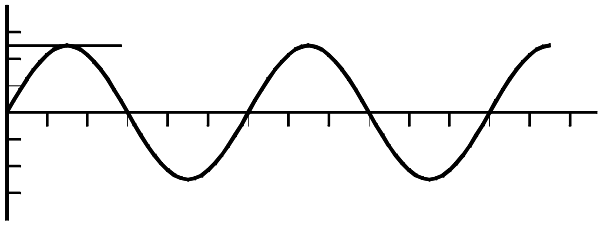

Figure 2: Question 1 (b)

(c) Calculate the corner frequency for the filter circuit shown in Figure 3. Plot the frequency response of the filter for a frequency range from 1kHz to 1MHz.

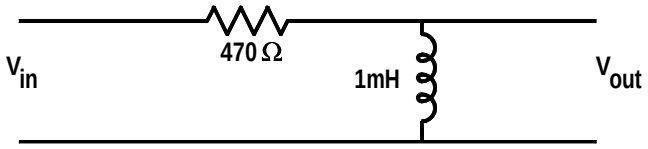

Figure 3: Question 1 (c)

(d) Calculate the amplitude of the output waveform from the circuit shown in Figure 4 when the input is a sinusoidal signal of amplitude 2V and frequency 2kHz.

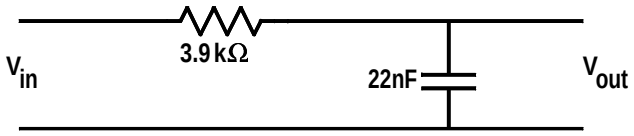

Figure 4: Question 1 (d)

(e) Calculate the Thevenin equivalent of the circuit shown in Figure 5.

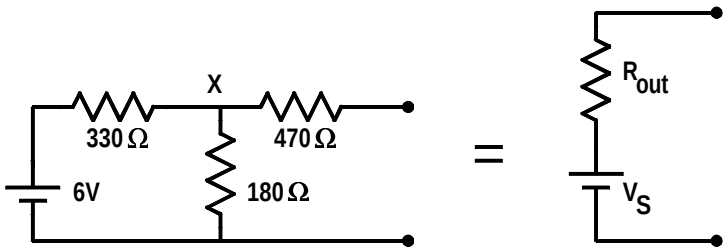

Figure 5: Question 1 (e)

(f) Calculate the current which flows in the 470Ω resistor in the circuit shown in Figure 6.

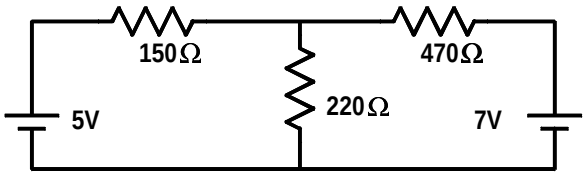

Figure 6: Question 1 (f)

(g) Calculate the voltages at nodes A, B and C in the circuit shown in Figure 7 when the input voltage is +25V.

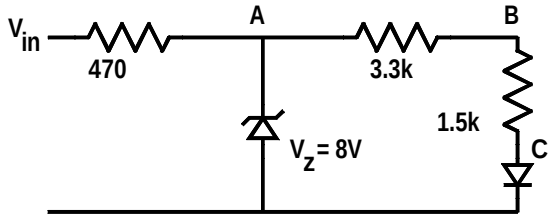

Figure 7: Question 1 (g)

(h) Calculate the current which flows in the circuit shown in Figure 8. The 1N4005 silicon diode passes a current of 1A for a forward voltage of 1.1V.

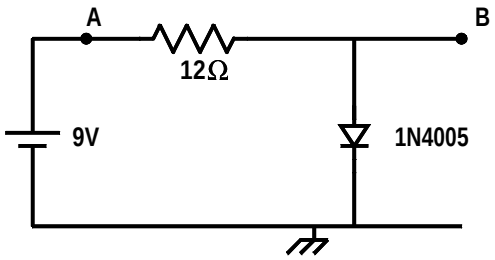

Figure 8: Question 1 (h)

Question 2. Calculate the emitter, base and collector voltages and currents for the amplifier shown in Figure 9.
Calculate the small signal voltage gain of the amplifier.
The current gain of the transistor is $\beta = 150$
Give scaled sketches of the oscilloscope displays of the voltage waveforms which you would observe at the base, collector and output for the sinusoidal input signal indicated on diagram.

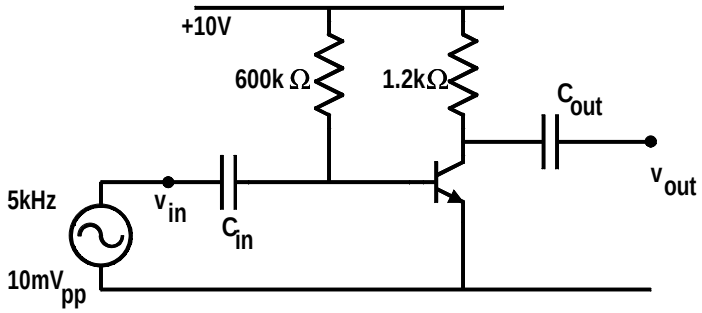

Figure 9: Question 2

Question 3. Calculate the source, gate and drain voltages for the circuit shown in Figure 10.
Calculate the voltage gain for the amplifier.
The JFET used has $I_{DSS} = 4.5\text{mA}$ and $V_{GS(off)} = -1.5\text{V}$.

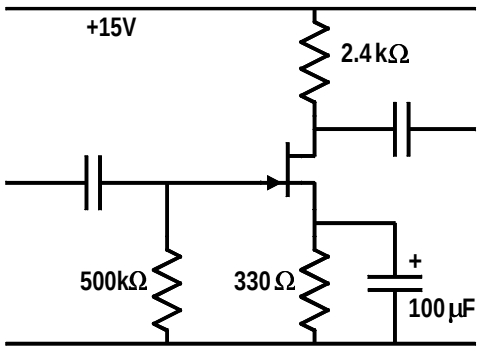

Figure 10: Question 3

Question 4. Calculate the voltage at each of the collectors of the differential amplifier circuit shown in Figure 11.
A DC voltage of 1.4mV is applied to Input 1 and a sinusoidal voltage of amplitude 2.0mV and frequency 3kHz is applied to Input 2. Give a scaled sketch of the voltage which would be observed using an oscilloscope connected to collector 2 (Vout) as shown in Figure 11.

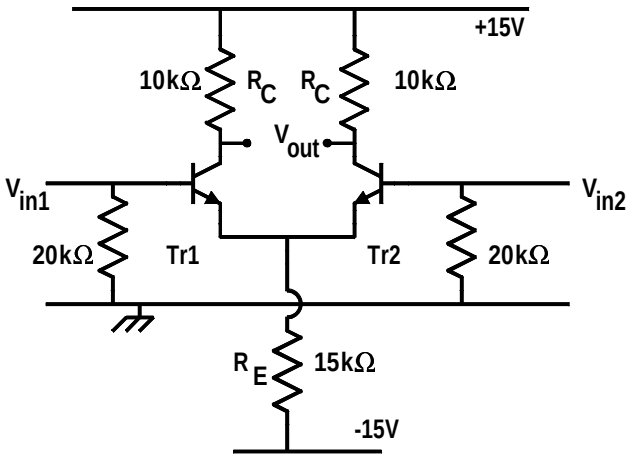

Figure 11: Question 4

Question 5. Explain the operation of the non-inverting amplifier shown in Figure 12 and derive an equation for the gain of the amplifier.
If $R_1 = 470\Omega$ and $R_2 = 270\Omega$ calculate the output voltage for an input voltage of 0.3V.

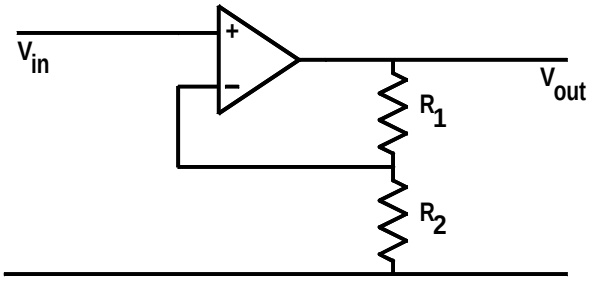

Figure 12: Question 5