DUBLIN CITY UNIVERSITY

August 2000

COURSE:	APPLIED PHYSICS PHYSICS with FRENCH PHYSICS with GERMAN
YEAR:	2
SEMESTER	1
MODULE:	Electronics 1; PS203
EXAMINER:	Dr B. Lawless
TIME ALLOWED:	2 hours
INSTRUCTIONS:	Answer 4 parts of Question 1 (50 %) and 2 other questions (25 % each)

Do not turn over this page
until instructed to do so.

Question 1. Answer four parts of this question.

(a) Plot a graph showing the variation of the output voltage from the circuit in Figure 1 as the value of the resistor R_1 is varied from 0 to 2kΩ.

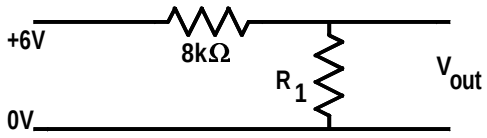

Figure 1: Question 1 (a)

(b) What is meant by the term "Corner frequency"?
Plot the attenuation of the filter circuit shown in Figure 2 as a function of frequency for a frequency range from 10Hz to 100kHz.

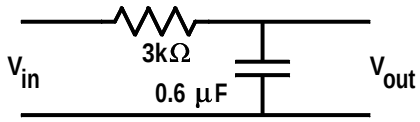

Figure 2: Question 1 (b)

(c) Calculate the voltages at Points A, B, C, D in the circuit shown in Figure 3.

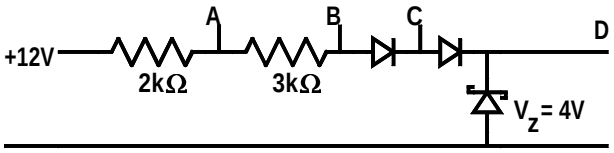

Figure 3: Question 1 (c)

(d) How will the brightness of each of the bulbs in the circuit shown in Figure 4 change when the switch, SW, is closed, (Out, Dimmer, the Same, Brighter). Explain your answer.

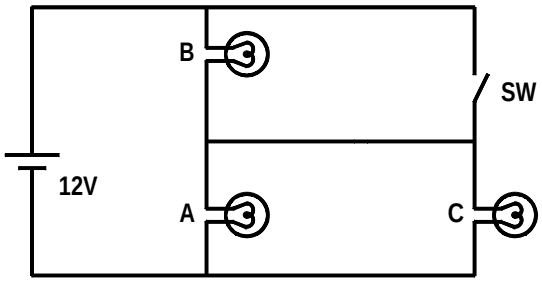

Figure 4: Question 1 (d)

(e) Calculate the current which flows in the 6Ω resistor in the circuit shown in Figure 5.

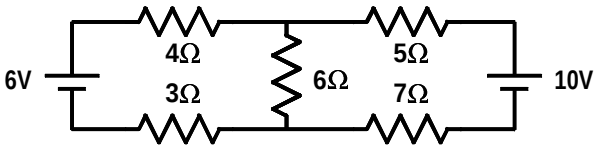

Figure 5: Question 1 (e)

(f) Plot a graph of the output voltage waveform from the circuit in Figure 6. Explain the shape of the output waveform.

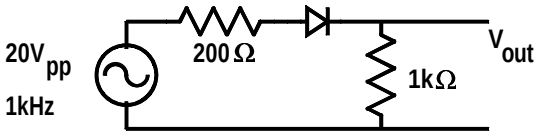

Figure 6: Question 1 (f)

Question 2. Explain the operation of the differential amplifier shown in Figure 7.
Derive an equation for the gain of this differential amplifier.
Calculate the DC voltages which appear at the emitter, base and collector of each of the transistors when no signal is applied at the inputs.
Calculate the voltage difference which appears as V_{out} when 10mV is applied at Input 1 and 17mV is applied at Input 2.
The transistors used in the circuit have a current gain of $\beta = 290$.

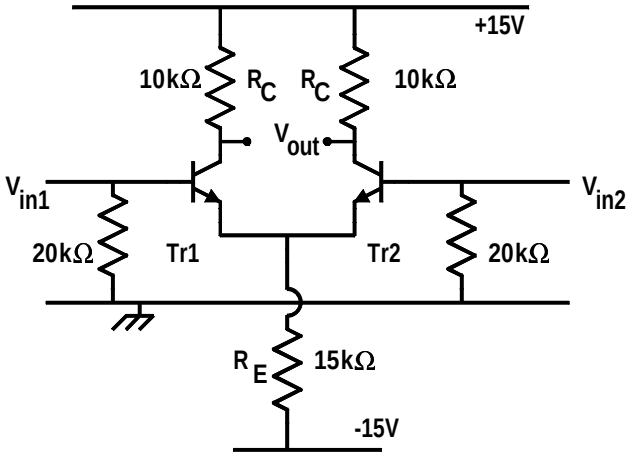

Figure 7: Question 2

Question 3. Explain, with the aid of diagrams, the construction and operation of a Junction Field Effect Transistor.
Explain how the two circuits shown in Figure 8 can be used to measure I_{DSS} and $V_{GS(off)}$ for a JFET.

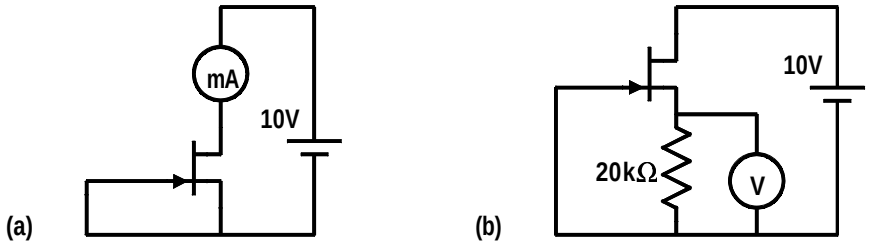

Figure 8: Question 3

Question 4. (a) Explain the operation of the inverting adder circuit shown in Figure 9. Derive the equation for the output voltage in terms of the input voltages and the resistors.

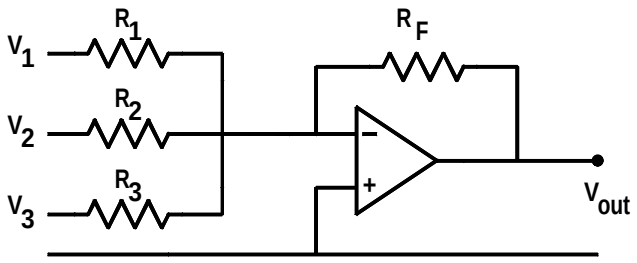

Figure 9: Question 4(a)

(b) Calculate the output voltage from this adder circuit when:
$V_1 = +0.2V, V_2 = -0.45V, V_3 = +0.18V$ and
$R_1 = 4.7k\Omega, R_2 = 5.6k\Omega, R_3 = 2.7k\Omega, R_F = 12k\Omega$.