DUBLIN CITY UNIVERSITY

August 2004

COURSE:	APPLIED PHYSICS PHYSICS with French PHYSICS with German Applied Physics Exchange
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) Calculate the voltages, relative to GND which would be measured at each of the nodes A, B, C, D, E and F of the circuit shown in Figure 1.

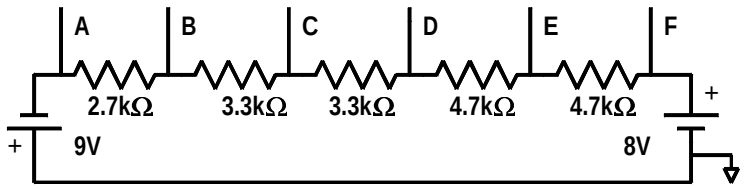

Figure 1: Question 1 (a)

(b) Calculate the voltage which would be measured between the output terminals of the circuit shown in Figure 2.

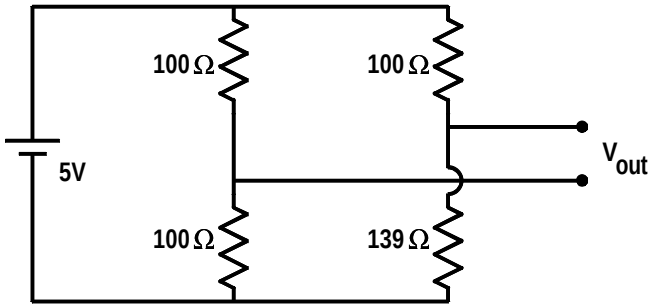

Figure 2: Question 1 (b)

(c) Calculate the amplitude of the output voltage from the circuit shown in Figure 3 when the input is a sinusoidal voltage of amplitude 6 V and at a frequency of 500Hz.

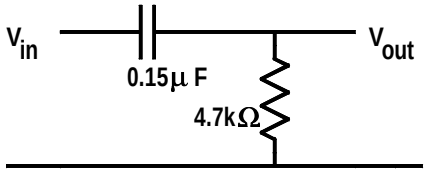

Figure 3: Question 1 (c)

(d) The voltage at the collector of the circuit in Figure 4 was measured to be 5.6 V. Calculate the current gain of the transistor.

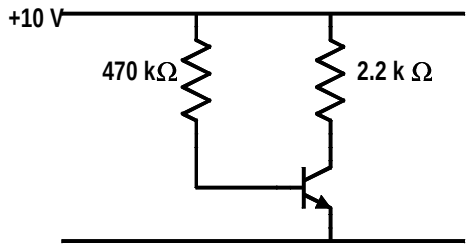

Figure 4: Question 1 (d)

(e) Calculate the current which flows in the 560 Ω resistor in the circuit shown in Figure 5.

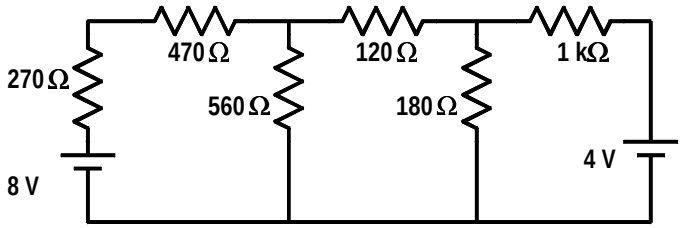

Figure 5: Question 1 (e)

(f) Calculate the voltages which would be measured at the nodes A, B, C and D in the circuit shown in Figure 6.

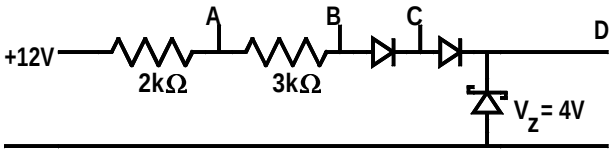

Figure 6: Question 1 (f)

(g) Give a scaled sketch of the waveform which would be observed on an oscilloscope connected to the output of the circuit shown in Figure 7. The input waveform is sinusoidal.

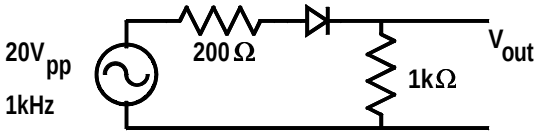

Figure 7: Question 1 (g)

(h) Sketch the Bode plot for the filter shown in Figure 8

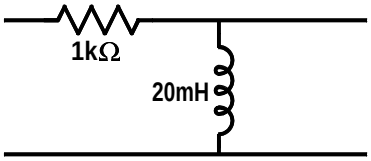

Figure 8: Question 1 (h)

Question 2. (a) Give an account of the operation of a transistor and explain what is meant by the current gain of a transistor, β.

(b) Calculate the amplitude of the output voltage waveform from the circuit shown in Figure 9 if the transistor used has a current gain of $\beta = 180$ and the input waveform has an amplitude of 5 mV and a frequency of 2 kHz.

(c) Give a scaled sketch of the input and output waveforms.

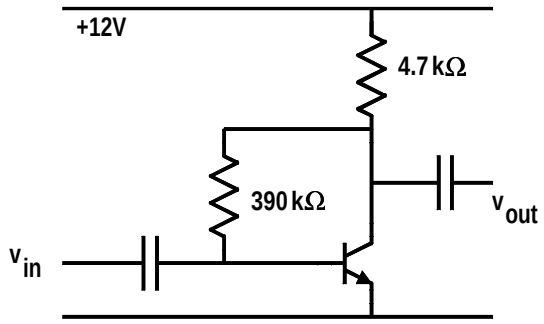

Figure 9: Question 2

Question 3. (a) Give an account of the construction and operation of a Junction Field Effect Transistor (JFET).

(b) Explain the meaning of the terms I_{DSS} and $V_{GS(off)}$ as they are used to specify a Field Effect Transistor.

(c) A particular JFET is tested using the circuits shown in Figure 10 and values of 4.5 mA and 2.7 V are measured using circuits (a) and (b). Calculate values for I_{DSS} and $V_{GS(off)}$ for this JFET.

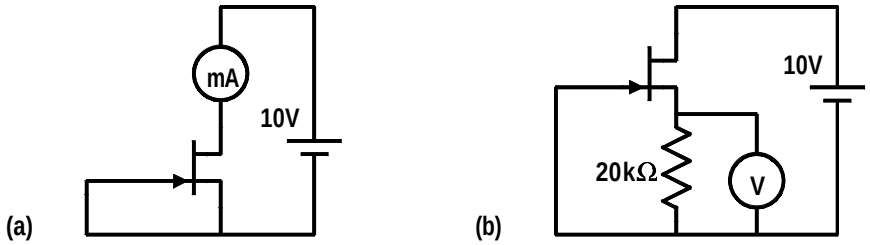

Figure 10: Question 3 (c)

(d) Calculate suitable resistor values for the source follower circuit shown in Figure 11.

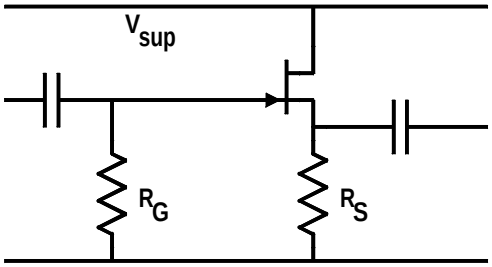

Figure 11: Question 3 (d)

Question 4. State the two basic rules used in the analysis of operational amplifier circuits. Use the rules to derive the equation which gives the gain of a noninverting amplifier such as that shown in Figure 12

Give scaled sketches of the input and output voltage waveforms for an input voltage of sinusouidal waveform at a frequency of 3.0 kHz and having an amplitude of 12 mV.

At what amplitude of the input signal will the output waveform become distorted?

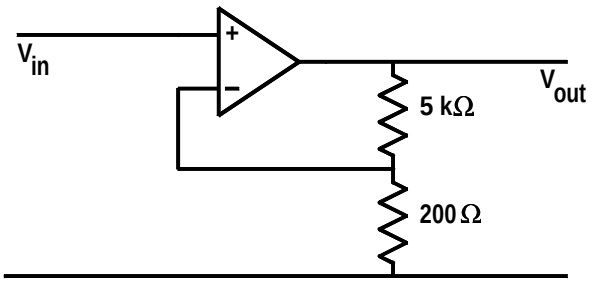

Figure 12: Question 4

Question 5. Give an account of the use of diodes in half wave and full wave rectification. Calculate the average output voltage and the ripple voltage for the full wave rectifier circuit shown in Figure 13.

Calculate the power which will be dissipated in the 75 Ω resistor.

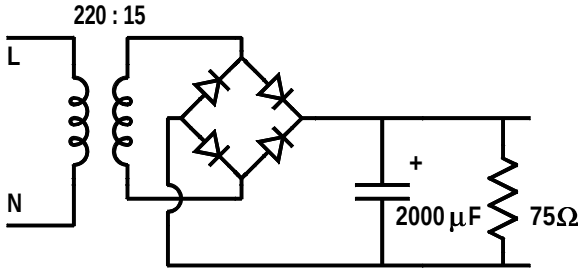

Figure 13: Question 5