DUBLIN CITY UNIVERSITY

January 2001

COURSE:	APPLIED PHYSICS PHYSICS with a LANGUAGE Applied Languages Exchange
] YEAR:	2
SEMESTER	1
EXAMINATION:	Electronics 1; PS203
EXAMINER:	Dr B. Lawless
DURATION:	2 hours
INSTRUCTIONS:	Answer 4 parts of Question 1 (50 %) and 2 other questions (25 % each)

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until instructed to do so.

Question 1. Answer four parts of this question.

(a) Sketch the frequency responses of each of the filters shown in Figure 1 and indicate on your plot the values of the corner frequency or resonant frequency.

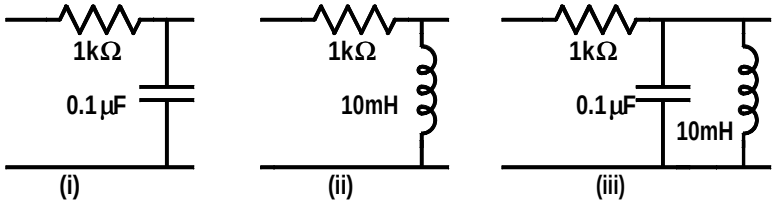

Figure 1: Question 1 (a)

(b) Calculate the complex impedance of the series circuit shown in Figure 2 for a frequency of 2.7kHz.
Plot the impedance on the complex impedance diagram.
Calculate the phase shift between the voltage and current waveforms.

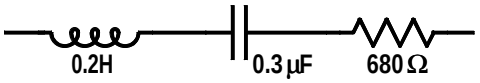

Figure 2: Question 1 (b)

(c) Calculate the Th´evenin equivalent of the circuit shown in Figure 3.

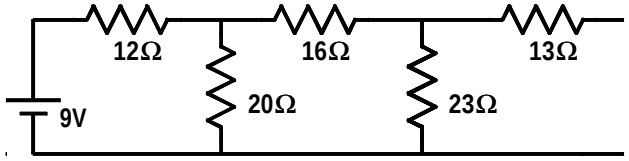

Figure 3: Question 1 (c)

(d) Calculate the current in the 680Ω resistor in the circuit in Figure 4.

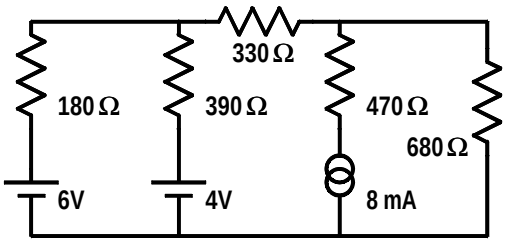

Figure 4: Question 1 (d)

(e) Calculate the voltages at points A, B, C and D in the circuit shown in Figure 5. Note that silicon diodes are used.

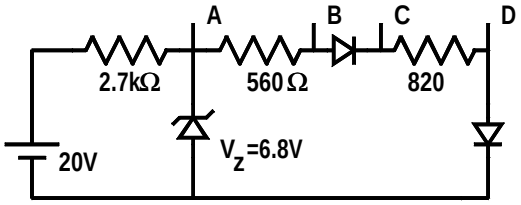

Figure 5: Question 1 (e)

(f) Calculate the voltages at the emitter, base and collector of the circuit in Figure 6. The current gain, $\beta = 150$.

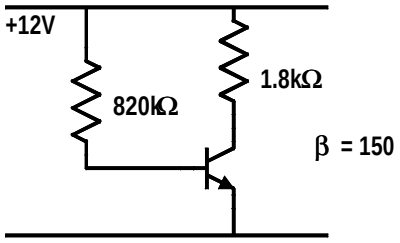

Figure 6: Question 1 (f)

(g) The collector voltage in the circuit in Figure 7 was measured to be $V_C = 4.3\text{V}$. Calculate the current gain for the transistor.

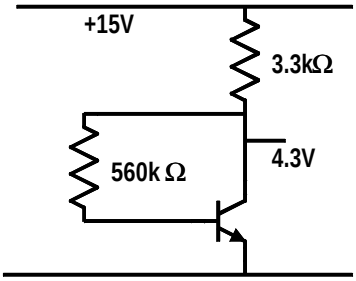

Figure 7: Question 1 (g)

Question 2. Explain what is meant by the terms:

(a) Biasing a transistor.

(b) Small signal voltage gain.

A sinusoidal signal of 30mV$_{pp}$ at 1kHz is applied to the input of the circuit shown in Figure 8. Give a scaled sketch of the waveforms which you would observe using an oscilloscope connected in turn to the input, the gate, the drain and the output of the circuit. The parameters for the JFET used are: $g_m = 2000\mu$S, $I_{DSS} = 6$mA and $V_{GS} = 3$V.

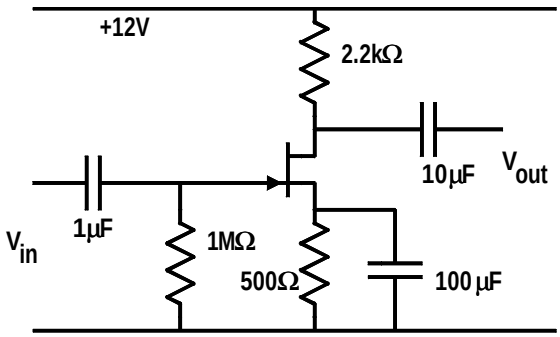

Figure 8: Question 2

Question 3. Derive the formula for the voltage gain of the non-inverting amplifier shown in Figure 9.

$$A = \frac{V_{out}}{V_{in}} = \left(1 + \frac{R_1}{R_2}\right)$$

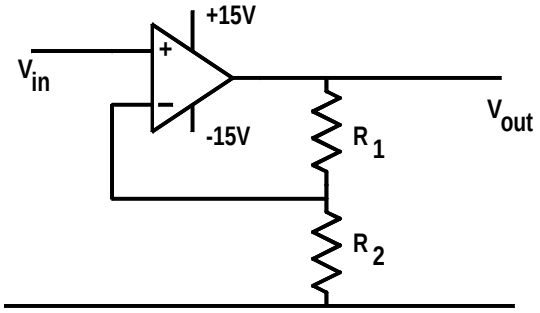

Figure 9: Question 3

Calculate the gain when $R_1 = 2$kΩ and $R_2 = 300\Omega$.
Plot the output voltage as a function of the input voltage for an input voltage range from -5V to +5V.
Explain any anomalies which might occur on this graph.

Question 4. (a) Give the output voltage as a function of the input voltages V_1, V_2 and V_3 for the circuit in Figure 10.
Write the numerical expression relating V_1, V_2, V_3 and V_{out} when $R_1 = 10\text{k}\Omega$, $R_2 = 3.3\text{k}\Omega$, $R_3 = 4.7\text{k}\Omega$ and $R_f = 27\text{k}\Omega$,

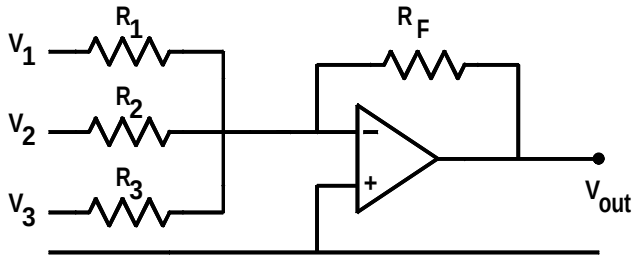

Figure 10: Question 4(a)

(b) Calculate the peak to peak output voltage from the circuit in Figure 11 when a sinusoidal signal at 1kHz and $V_{pp} = 3\text{mV}$ is applied as shown.

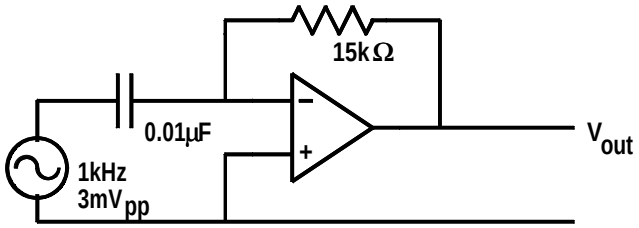

Figure 11: Question 4(b)