PH3104 Problem Set 6

Q 1) A 1N2615 silicon diode has a reverse saturation current I_s of $10\,\mu$A at 22°C.

(a) Plot the diode current against voltage at this temperature (choose a reasonable range for the voltage).

(b) This diode has a maximum dc current rating of 750 mA. Determine the maximum safe forward voltage that it can be subjected to.

(c) What is the expected reverse saturation current at 72°C?

(You may have to look up relevant parameter values on the net.)

Q 2) Work out the Fourier series for the output from (a) an ideal half wave rectifier, and (b) an ideal full wave rectifier.

Q 3) a) The current output of a rectifier can be expressed as $I = I_{\mathrm{dc}} + I_r$. Show that

$$\left\langle I^2 \right\rangle = \left\langle I_r^2 \right\rangle + I_{\mathrm{dc}}^2$$

where the $\langle \ldots \rangle$ denote average over time.

b) Use this Derive the expressions for the ripple factor for both the ideal full wave and half wave rectifier.

Q 4) The diodes in a bridge rectifier are connected in a particular way. Discuss the different ways in which you can connect the diodes ***wrongly*** (I mean reverse the p and the n side), and describe the output through the resistance in each case. Assume that all the diodes are ideal.

Hint : reversing all the diodes does not count as a wrong connection - can you see why?

Q 5) A full wave rectifier is connected to the 220 V ac mains by a 20:1 step down transformer with a center tap. Determine the peak, dc and rms values of the output, assuming that the diodes are ideal.