

The supply current was sampled 1024 times over a very short time interval. The data so obtained is given in column B of the accompanying *Excel* worksheet¹. This worksheet has been set up to give a graph showing the spectral components of the data.

Question 3

- i) Obtain the Fourier Transform for the data using the Fourier Analysis tool of *Excel*. The transformed data should commence in cell D2.
- ii) Identify the principal frequencies in the current waveform.
- iii) *Estimate* the total harmonic distortion [*THD*] present in the current waveform using the formula:

$$THD(I) = \frac{1}{I_1} \sqrt{\sum_{n=2}^{\max} (I_n)^2} \times 100\%$$

where I_1 is the r.m.s. value of the fundamental current, I_n the r.m.s value of the n th harmonic and $n(\max)$ is the number of the highest measurable or significant harmonic.

[Note the vertical axis of the spectrum graph is scaled in (current)².]

- iv) Attempt to synthesise the shape of the original waveform from its principal harmonics [e.g. sketch the waveforms of the harmonics on the same time axis and add them together].

Q4. *Sketch*, on a set of common axes, waveforms to represent the transient response of circuits having transfer functions with the following parameters:

- a) $\zeta = 0.5, \omega_0 = 1 \times 10^3 \text{ rad s}^{-1}$
- b) $\zeta = 0.2, \omega_0 = 2 \times 10^3 \text{ rad s}^{-1}$
- c) $\zeta = 2, \omega_0 = 1 \times 10^3 \text{ rad s}^{-1}$

¹ The spreadsheet can be found with the assessment material on Blackboard .