Exercise 2:

(a) A frequency modulation (FM) modulator has modulation index of m = 2. The modulator is fed with modulating signal $V_m(t) = V_m \sin(2\pi 2000\, t)$ and unmodulated carrier $V_c(t) = 8\sin(2\pi 800k\, t)$. A load resistance R_L = 50 Ω is also present.

(i) Using Bessel table determine the amplitudes of carrier and sidebands signals after the modulation.

(ii) Draw the frequency spectrum showing the amplitudes of the frequencies.

(iii) Calculate actual minimum bandwidth from the Bessel function.

(iv) Calculate approximate minimum bandwidth using Carson's rule.

(v) Calculate the unmodulated carrier power for the FM modulator.

(vi) Calculate the total power in the FM wave.

[10 Marks]