Tutorial 6 – Frequency Modulation

1. An FM modulator has a conversion gain of 10 kHz/V. Its carrier frequency is set to 200 kHz.

   Plot a graph showing how the output frequency changes when the modulating signal in Figure T6.1 is applied. Indicate the frequency at t_1, t_2, t_3 and t_4.

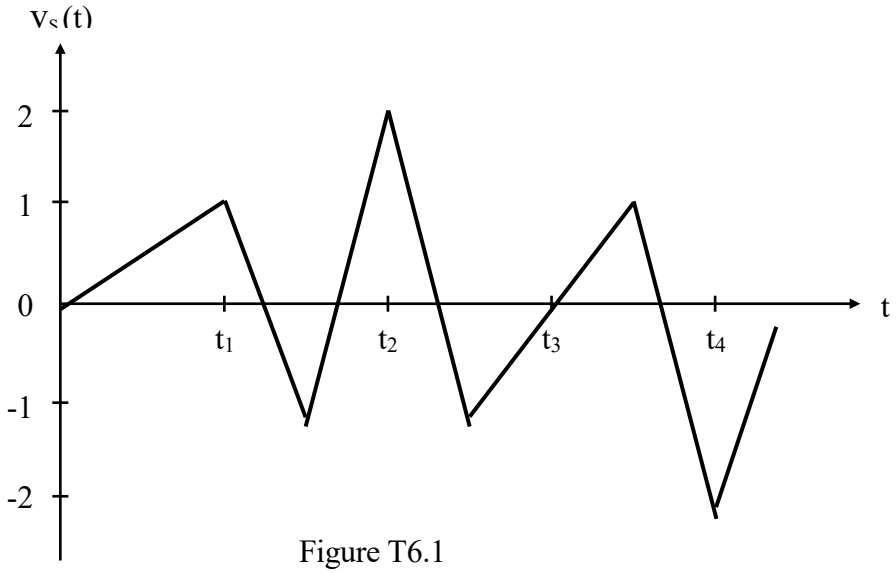

Figure T6.1

2. A 2.4 V_{peak}, 500 Hz sinusoidal modulating signal when fed to a frequency modulator results in a peak frequency deviation of 4.8 kHz.

   (a) Calculate the conversion gain of the modulator.

   (b) What is the peak frequency deviation when the peak amplitude of the modulating signal is increased to 7.2 V?

   (c) What is the modulation index in each case?

3. A 100 MHz carrier is frequency modulated by a 5 kHz sine wave to a modulation index of 4. Given that the conversion gain of the demodulator is 6 mV/kH. Determine the peak output voltage of the demodulator.

4. A 2 V_{peak}, 100 MHz sinusoidal carrier is frequency modulated by a 4 V_{peak}, 2 kHz sinusoidal signal. The modulator has a conversion gain of 3 kHz/V.
   (a) State, with reason, whether it is narrowband or wideband transmission.
   (b) Calculate the bandwidth of the FM signal.
   (c) Calculate the total FM power if dissipated over a 50Ω load.

5. When the modulation index of an FM signal increases from 2 to 6, the transmitted power
   (a) increases by 3 times
   (b) increases by 9 times
   (c) remains the same
   (d) reduces by 9 time

6. (a) List 4 advantages and 1 disadvantage of wideband FM.
   (b) List 4 advantages and 1 disadvantage of narrowband FM.
   (c) The transmission power of FM can be lower than that of AM to cover the same area. Why?