

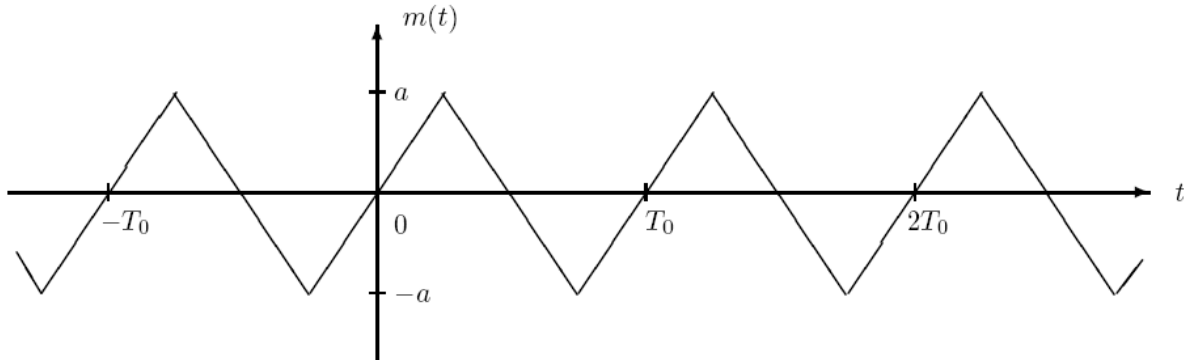
"I have neither given nor received unauthorized aid on this examination"

Name: \_\_\_\_\_

Section: \_\_\_\_\_

Signature: \_\_\_\_\_

Angle Modulation:



Consider the *periodic* message signal  $m(t)$  shown in the picture, and assume initially that  $a = 1$  and  $T_0 = 10^{-3}$ .

Consider the (essential) bandwidth of the signal  $W$  to be the frequency corresponding to the fifth harmonic, i.e.  $W = \frac{5}{T_0}$  Hz. Now, suppose  $m(t)$  is angle modulated on a 1 MHz carrier.

- Find the bandwidth of an FM signal with  $k_f = 100$ .
- Find the bandwidth of a PM signal with  $k_p = 2\pi \times 10^2$ .
- How much is the percentage of message power lost by dropping the contribution of components above the fifth harmonics.
- For the FM case is this narrowband FM or Wideband FM, justify your answer.