

Sampling and TDM Quiz

Four (4) sinusoidal signals (in phase):

$$x_1(t) = 2 \sin(2\pi 1000t)$$

$$x_2(t) = 4 \sin(2\pi 1000t)$$

$$x_3(t) = 6 \sin(2\pi 1000t)$$

$$x_4(t) = 8 \sin(2\pi 1000t)$$

are sampled and Time Division Multiplexed at $F_s = 4\text{KHz}$

The four signals are connected to a commutator with the sequence that:

The first one at 45° , the second at 135° , the third at 225° and the fourth at 315°

The synchronization is done by adding a mark pulse at 345.6°

The contact time for each signal and mark generator is 0.01 msec .

Solve for:

1. Sketch the TDM system scheme
2. Find the value of each sample (at beginning and end)
3. Draw the time diagram of sampled signal
4. Find the signaling rate and bandwidth of the multiplexed signal.

Solution of Sampling and TDM QUIZ

Since $F_s = 4\text{KHz}$ then $T_s = 1/4 \times 10^3 \text{ sec.} = 0.25 \text{ msec.}$

The commutator complete 1 revolution within this time. (360° in 0.25 msec.)

The commutator start contact $x_1(t)$ at $t = (45/360) * 0.25 = 0.03125 \text{ msec.}$

The time for each degree = $0.25 / 360 \text{ msec.}$

The commutator end contact $x_1(t)$ at $t = 0.03125 + 0.01 = 0.04125 \text{ msec.}$

The same for $x_2(t)$, $x_3(t)$ and $x_4(t)$

For mark pule, it starts at $t = (345.6/360) \times 0.25 = 0.24 \text{ msec.}$

It ends at $t = 0.24 + 0.01 = 0.25$

Signal	Start time (msec.)	End time (msec.)
$x_1(t)$	0.03125	0.04125
$x_2(t)$	0.21875	0.22875
$x_3(t)$	0.15625	0.16625
$x_4(t)$	0.21875	0.22875
Mark pulse	0.24	0.25