

# Gate Assignment 4

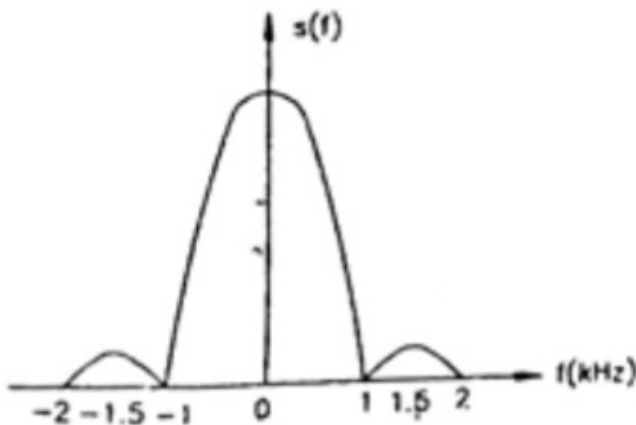
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<https://github.com/YashasTadikamalla/EE3900/blob/main/GateAssignment4/GateAssignment4.tex>

## 1 PROBLEM (EC-1997 Q1.10)

A deterministic signal has the power spectrum given in the figure. The minimum sampling rate needed to completely represent this signal is



- 1) 1KHz
- 2) 2KHz
- 3) 3KHz
- 4) None

## 2 SOLUTION

**Definition 2.1** (Power spectrum). *Power Spectral density, or simply, Power spectrum, denoted by  $s(f)$  is defined as*

$$s(f) = |X(f)|^2 \quad (2.0.1)$$

**Theorem 2.1** (Sampling Theorem). *If a continuous time signal contains no frequency components higher than  $W$  Hz, then the sampling rate at which the continuous time signal needs to be sampled uniformly, so as to completely recover the original signal is given by*

$$f_s \geq 2W \quad (2.0.2)$$

**Definition 2.2** (Nyquist rate). *The minimum sampling rate is also called as Nyquist rate. It is given by*

$$f_s = 2W \quad (2.0.3)$$

Given, power spectrum of a deterministic signal. From (2.1), we can observe that no frequency component exceeds 2KHz. Hence,

$$W = 2KHz \quad (2.0.4)$$

From (2.0.3),

$$f_s = 2W \quad (2.0.5)$$

$$= 2(2) = 4KHz \quad (2.0.6)$$

Hence, option 4 is the correct answer.