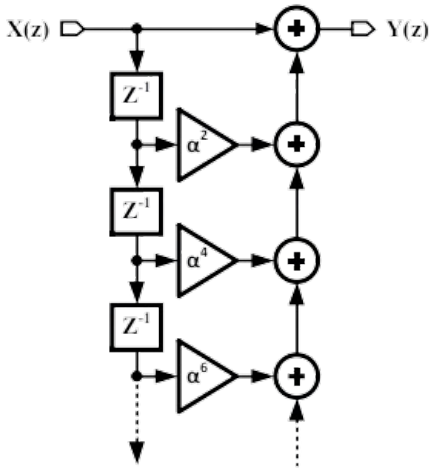
GATE 11.9.4 Q-1

EE23BTECH11207 -KAILASH.C*

In the block diagram shown below, an infinite tap FIR filter with transfer function $H(z) = \frac{Y(z)}{X(z)}$ is realized. If $H(z) = \frac{1}{1-0.5z^{-1}}$.
the value of α is



Solution:

Parameter	Definition	Value
$H(z)$	Input Transfer Function	$\frac{1}{1-0.5z^{-1}}$

TABLE 0
Parameter Table

From diagram we have:

$$Y(z) = X(z)\left(\sum_{n=0}^{\infty}\left(z^{-1}\alpha^2\right)^n\right) \tag{1}$$

Dividing by $X(z)$ in both sides:

$$\frac{Y(z)}{X(z)} = \sum_{n=0}^{\infty}\left(z^{-1}\alpha^2\right)^n \tag{2}$$

$$H(z) \implies \sum_{n=0}^{\infty}\left(z^{-1}\alpha^2\right)^n \tag{3}$$

$$\frac{1}{1-0.5z^{-1}} = \sum_{n=0}^{\infty}\left(z^{-1}\alpha^2\right)^n \tag{4}$$

$$\frac{1}{1-0.5z^{-1}} = \frac{1}{1-z^{-1}\alpha^2} \tag{5}$$

$$\alpha \implies \frac{1}{\sqrt{2}} \tag{6}$$