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Q. find whether the following systems are stable or not

(a) $h(t) = (2 + e^{-3t})u(t)$

Sol:- for stability

$$\int_{t=-\infty}^{\infty} |h(t)| < \infty$$

Now, $$\int_{t=-\infty}^{\infty} |h(t)|dt = \int_{t=-\infty}^{\infty} |(2+e^{-3t})u(t)|dt$$

$$= \int_{0}^{\infty} (2+e^{-3t})dt$$

$$= \left[2t + \frac{e^{-3t}}{-3}\right]_0^{\infty}$$

$$= \infty \left[0 \cdot \infty + 0\right] - \left[0 - \tfrac{1}{3}\right]$$

$$= \infty$$

$\therefore$ $h(t)$ is unstable

(b) $h(t) = e^{2t}u(t)$

Sol:- for stability,

$$\int_{t=-\infty}^{\infty} |h(t)|dt < \infty$$

$$\therefore \int_{-\infty}^{\infty} |h(t)|dt = \int_{-\infty}^{\infty} |e^{2t}u(t)|dt$$

$$= \int_{0}^{\infty} e^{2t}dt$$

$$= \left[\frac{e^{2t}}{2}\right]_0^{\infty}$$

$$= \frac{e^{\infty}}{2} - \frac{e^{0}}{2}$$

$$= \infty - 1/2$$

$$= \infty$$

$\therefore$ $h(t)$ is unstable.

(c) $h(n) = 3^n u(-n)$

Sol^n: For stability,

$$\sum_{n=-\infty}^{\infty} |h(n)| < \infty$$

Now, $$\sum_{n=-\infty}^{\infty} |h(n)| = \sum_{n=-\infty}^{\infty} |3^n u(-n)|$$

$$= \sum_{n=-\infty}^{0} (3^n)$$

$$= 3^0 + 1/3 + 1/9 + 1/27 + \cdots$$

$$= 1 + 1/3 + 1/9 + 1/27 + \cdots \quad < \infty$$

Hence, $h(n)$ is stable //