

## Lecture - 5

Q. Evaluate :-

$$\textcircled{1} -3 \int_{-\infty}^{\infty} (t+1) \delta(t) dt$$

Sol<sup>n</sup>:  $-3 \int_{-\infty}^{\infty} (t+1) \delta(t) dt$   
 $= |t+1|_{t=0}$   
 $= \underline{\underline{\frac{1}{1}}}$

$$\textcircled{2} -3 \int_{-\infty}^{\infty} (t^2+1) \delta(t) dt$$

Sol<sup>n</sup>:  $-3 \int_{-\infty}^{\infty} (t^2+1) \delta(t) dt$   
 $= 0$

\* When you are having unit impulse function, the integration limits must contain zero.

$$\textcircled{3} -2 \int_{-\infty}^{\infty} e^{-at} u(t) dt$$

$$= 0 \quad [u(t) \text{ has value from } 0 \text{ to } \infty]$$

$$\textcircled{4} -2 \int_{-\infty}^{\infty} e^{(2-t)} \delta(t-2) dt$$

$$= |e^{2-t}|_{t=2}$$
$$= e^0$$
$$= \underline{\underline{1}}$$

Q. Find the following summations :-

$$\textcircled{a} \sum_{n=-\infty}^{\infty} e^{3n} \delta(n-3)$$

Sol<sup>n</sup>: We know,  $\delta(n-3) = \begin{cases} 1, & n=3 \\ 0, & n \neq 3 \end{cases}$

$$\therefore \sum_{n=-\infty}^{\infty} e^{3n} \delta(n-3) = |e^{3n}|_{n=3} = \underline{\underline{e^9}}$$

(14)

$$\begin{aligned} \textcircled{b} \sum_{n=-\infty}^{\infty} \delta(n-2) \cos 3n \\ &= \lfloor \cos 3n \rfloor_{n=2} \\ &= \cos 6 \end{aligned}$$

$$\begin{aligned} \textcircled{c} \sum_{n=-\infty}^{\infty} n^2 \delta(n+4) \\ &= \lfloor n^2 \rfloor_{n=-4} \\ &= 16 \end{aligned}$$

$$\begin{aligned} \textcircled{d} \sum_{n=-\infty}^{\infty} \delta(n-2) e^{n^2} \\ &= \lfloor e^{n^2} \rfloor_{n=2} \\ &= e^4 \end{aligned}$$

$$\begin{aligned} \textcircled{e} \sum_{n=0}^{\infty} \delta(n+1) 4^n \\ &= 0 \quad \left[ \because \delta(n+1) = 1 \text{ for } n = -1 \right. \\ &\quad \left. \& \delta(n+1) = 0 \text{ for } n \neq -1 \right] \end{aligned}$$

Q. Evaluate :-

$$\begin{aligned} \textcircled{a} \int_{-\infty}^{\infty} (t-1)^2 \delta(t-1) dt \\ &= \lfloor (t-1)^2 \rfloor_{t=1} \\ &= 0 \end{aligned}$$

$$\begin{aligned} \textcircled{b} \sum_{n=-\infty}^{\infty} \delta(n) \sin n \\ &= \lfloor \sin 2n \rfloor_{n=0} \\ &= 0 \end{aligned}$$

$$\begin{aligned} \textcircled{c} \sum_{n=-\infty}^{\infty} n^2 \delta(n-3) \\ &= \lfloor n^2 \rfloor_{n=3} \\ &= 9 \end{aligned}$$

$$\begin{aligned} \textcircled{d} \int_0^{\infty} t^3 \delta(t-2) dt \\ &= \lfloor t^3 \rfloor_{t=2} \\ &= 2^3 \\ &= 8 \end{aligned}$$

$$\begin{aligned} \textcircled{e} \int_{-\infty}^{\infty} \delta(t+3) e^{-2t} dt \\ &= \lfloor e^{-2t} \rfloor_{t=-3} \\ &= e^{-2 \times (-3)} \\ &= e^6 \end{aligned}$$