



## DEPARTMENT OF MATHEMATICS

### UNIT -V LAPLACE TRANSFORM

#### INVERSE LAPLACE TRANSFORM

Defn: If the Laplace Transform of  $f(t)$  is  $F(s)$  i.e.  $L[f(t)] = F(s)$   
Then  $f(t)$  is called an inverse Laplace Transform of  $F(s)$  and is written as  $f(t) = L^{-1}[F(s)]$  where  $L^{-1}$  is called the inverse Laplace transformation operator.

#### Table of ILT:

$$L[f(t)] = F(s) \quad L^{-1}[F(s)] = f(t)$$

$$1) L[1] = \frac{1}{s} \quad \Rightarrow \quad L^{-1}\left[\frac{1}{s}\right] = 1$$

$$2) L[t] = \frac{1}{s^2} \quad \Rightarrow \quad L^{-1}\left[\frac{1}{s^2}\right] = t$$

$$3) L[t^n] = \frac{n!}{s^{n+1}} \quad \Rightarrow \quad L^{-1}\left[\frac{n!}{s^{n+1}}\right] = t^n$$

$$4) L[e^{at}] = \frac{1}{s-a} \quad \Rightarrow \quad L^{-1}\left[\frac{1}{s-a}\right] = e^{at}$$

$$5) L[e^{-at}] = \frac{1}{s+a} \quad \Rightarrow \quad L^{-1}\left[\frac{1}{s+a}\right] = e^{-at}$$

$$6) L[\sin at] = \frac{a}{s^2+a^2} \quad \Rightarrow \quad L^{-1}\left[\frac{a}{s^2+a^2}\right] = \sin at$$

$$7) L\left[\frac{\sin at}{a}\right] = \frac{1}{s^2+a^2} \quad \Rightarrow \quad L^{-1}\left[\frac{1}{s^2+a^2}\right] = \frac{\sin at}{a}$$



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$$8) \mathcal{L}[\cos at] = \frac{s}{s^2 + a^2} \Rightarrow \mathcal{L}^{-1}\left[\frac{s}{s^2 + a^2}\right] = \cos at$$

$$9) \mathcal{L}[\sin at] = \frac{a}{s^2 - a^2} \Rightarrow \mathcal{L}^{-1}\left[\frac{a}{s^2 - a^2}\right] = \sin at$$

$$10) \mathcal{L}[\cosh at] = \frac{s}{s^2 - a^2} \Rightarrow \mathcal{L}^{-1}\left[\frac{s}{s^2 - a^2}\right] = \cosh at$$

$$11) \mathcal{L}[\delta(t)] = 1 \Rightarrow \mathcal{L}^{-1}[1] = \delta(t)$$