



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:

$$L[f(t)] = F(s)$$

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

$$1) L[1] = \frac{1}{s}$$

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

$$2) L[t] = \frac{1}{s^2}$$

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

$$3) L[t^n] = \frac{n!}{s^{n+1}}$$

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

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

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

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

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

$$6) L[\sin at] = \frac{a}{s^2+a^2}$$

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

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

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



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

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

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

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