

EM-III- Tutorial-1 (CMPN)

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Module-1- Laplace Transform

(University Que. Paper Weightage Appx. 20 Marks)

1. Find $L[g(t)]$ If $g(t) = \begin{cases} \sin\left(\frac{2k-3t}{3}\right) & , t > \frac{2k}{3} \\ 0 & , 0 < t < \frac{2k}{3} \end{cases}$
2. Find Laplace Transform of $t\sqrt{1+\sin t}$ (Dec-10,12,15,May -09,13,15,16,19)
3. Find Laplace Transform of $\frac{e^{-at} - \cos(at)}{t}$ (Dec-08,13,16,May -13,18)
4. Find Laplace Transform of $e^{-t} \int_0^t \frac{\sin u}{u} du$ (Dec-14,May -15)
5. IF $\int_0^\infty e^{-2t} \sin(t+\alpha) \cos(t-\alpha) dt = \frac{3}{8}$ then find α (Dec 09,14, May -12,16)
6. Evaluate the integral $I = \int_{t=0}^{t=\infty} \frac{\sin(\sqrt{3}t)}{te^t} dt$ using Laplace Transform (Dec-12)
7. Find Laplace Transform of $f(t) = e^{-4t} \int_{u=0}^{u=t} u \sin(3u) du$ (Dec-16, May -12,15)
8. Prove that $L[erf(\sqrt{t})] = \frac{1}{s\sqrt{s+1}}$, hence find $L[erfc(\sqrt{t})]$
9. Find $L[f(t)]$ if $f(t) = |t-1| + |t+1|$ for $t \geq 0$ (NIT Kurukshetra 03, IITD 10)
10. Find $L[f(t)]$ if $f(t) = \int_t^\infty \frac{\cos u}{u} du$
11. Answer the following MCQs with proper Justification.

11.1	The Sufficient conditions for Existence of Laplace transform of $f(t)$ are
Option A	If $f(t)$, $t \geq 0$ be Piecewise discontinuous on $[0, \infty)$ and of Exponential order a , then $L[f(t)] = f(s)$ exists for $s > a \geq 0$
Option B	If $f(t)$, $t \geq 0$ be Piecewise continuous on $[0, \infty)$ and of Exponential order a , then $L[f(t)] = f(s)$ exists for $s > a \geq 0$
Option C	If $f(t)$, $t \geq 0$ be Piecewise continuous on $[0, \infty)$ and of non-Exponential order a , then $L[f(t)] = f(s)$ exists for $s > a \geq 0$

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Option D	If $f(t)$, $t \geq 0$ be Piecewise discontinuous on $[0, \infty)$ and of non-Exponential order a , then $L[f(t)] = f(s)$ exists for $s > a \geq 0$
11.2	If $f(t)$ is an exponential order of ' a ', means that
Option A	$ f(t) \leq ae^{kt}$, $\forall t \geq 0$, where $a, k > 0$ and constants
Option B	$ f(t) \geq ke^{at}$, $\forall t \geq 0$, where $a, k > 0$ and constants
Option C	$ f(t) \geq ae^{kt}$, $\forall t \geq 0$, where $a, k > 0$ and constants
Option D	$ f(t) \leq ke^{at}$, $\forall t \geq 0$, where $a, k > 0$ and constants
11.3	If $L[f(t)] = f(s)$ Then, Laplace transform of $\frac{d^3}{dt^3}f(t) =$
Option A	$s^3 f(s) - s^2 f(0) - s f'(0) - f''(0)$
Option B	$s^3 f(s) - s^2 f(0) - s f'(0) - f''(0)$
Option C	$s^3 f(s) - s^2 f(0) - s f'(0) - f''(0)$
Option D	$s^3 f(s) - s^2 f(0) - s f'(0) - f''(0)$
11.4	Which of the following function $f(t)$ satisfies the sufficient conditions for Existence of Laplace transform.
Option A	$f(t) = e^{t^2}$
Option B	$f(t) = \frac{e^{-at}}{t}$
Option C	$f(t) = \frac{\sin(t)}{t}$
Option D	$f(t) = \frac{\cos(t)}{t}$
11.5	If $L\{f(t)\} = \frac{1}{s+1}$, then value of $f(0)$ & $f(\infty)$ will be
Option A	1, 0 respectively
Option B	-1, 0 respectively
Option C	1, -1 respectively
Option D	2, 0 respectively