

PRACTICE SHEET - 8

(INVERSE LAPLACE TRANSFORM)

Course : B.Sc. (H) Physics
Semester : IV
Subject : Mathematical Physics III
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1. If $L^{-1}\left\{\frac{1}{s}e^{-1/4s}\right\} = J_0(\sqrt{t})$, find (i) $L^{-1}\left\{\frac{1}{s}e^{-a^2/4s}\right\}$ and (ii) $L^{-1}\left\{\frac{1}{s}e^{-a/s}\right\}$.
2. Find Inverse Laplace Transform of the following functions:

(i) $\frac{-s-10}{s^2-s-2}$	(ii) e^{-2s/s^2}	(iii) $\frac{4s+12}{s^2+8s+16}$
(iv) $\frac{(s+1)e^{-\pi s}}{s^2+s+1}$	(v) $\frac{1}{s^3(s^2+1)}$	(vi) $4\left(\frac{e^{-2s}-e^{-5s}}{s}\right)$
(vii) $\frac{2s^3}{s^4-1}$	(viii) $\frac{1}{s^2}\left(\frac{s-1}{s+1}\right)$	(ix) $\frac{\pi^5}{s^4(s^2+\pi^2)}$
3. Using Convolution Theorem for Laplace Transform, find Inverse Laplace Transform of the following functions:

(i) $\frac{1}{(s^2+a^2)^2}$,	(ii) $\frac{1}{s^2(s^2+a^2)}$,	(iii) $\frac{s^2}{(s^2+a^2)^2}$,
(iv) $\frac{1}{s^2(s-a)}$,	(v) $\frac{1}{(s^2+a^2)(s^2+b^2)}$.	
4. Find $L^{-1}\left(e^{-\sqrt{s}}\right)$ and hence find

(i) $L^{-1}\left(e^{-k\sqrt{s}}\right)$	(ii) $L^{-1}\left(\frac{e^{-k\sqrt{s}}}{\sqrt{s}}\right)$	(iii) $L^{-1}\left(\frac{e^{-k\sqrt{s}}}{s}\right)$.
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5. Evaluate (using LT): (i) $\int_0^\infty \frac{\sin x}{\sqrt{x}} dx$, (ii) $\int_0^\infty \sin x^2 dx$, (iii) $\int_0^\infty \frac{x \sin ax}{x^2+1} dx$.
6. Prove that $L^{-1}\left(\tan^{-1} \frac{2}{p^2}\right) = \frac{2}{t} \sin t \sinh t$.
7. Find (i) $L^{-1}\left\{\frac{s-1}{(s+3)(s^2+2s+2)}\right\}$ (ii) $L^{-1}\left\{\frac{s}{(s^2-2s+2)(s^2+2s+2)}\right\}$.