

Name of Faculty: Dr. Sanjeet Kumar

Designation: Professor & Head

Department: Mathematics,

LNCT&S, Bhopal (M.P)

Assignment-4

Subject: Mathematics-III

(BT-401)

(Common to CS/IT/EX/EE)

Topic: Transform Calculus

1. Find the Laplace Transform

(i) $3t^4 - 2t^3 + 4e^{-3t} - 2\sin 5t + 3\cos 2t$ (ii) $e^{-3t} \cdot \cos 4t$ (iii) $t \cdot \sin 2t$ (iv) $t \cdot e^{-t} \sin 2t$

(v) $t^2 \cdot \sin at$ (vi) $\frac{\cos at - \cos bt}{t}$ (vii) $\int_0^t e^{-t} \cdot \cos t \, dt$ (viii) $\int_0^\infty t \cdot e^{-4t} \cdot \sin t \, dt$

2. Find the Inverse Laplace Transform

(i) $\log\left(\frac{s+1}{s-1}\right)$ (ii) $\log\left(1 + \frac{1}{s^2}\right)$ (iii) $\log\left(\frac{s+a}{s+b}\right)$ (iv) $\log\left(\frac{s^2-1}{s^2}\right)$ (v) $\frac{s}{(s^2+1)(s^2+4)}$

3. Applying convolution Theorem, Evaluate:

(i) $L^{-1}\left[\frac{s}{(s^2+1)(s^2+4)}\right]$

(ii) $L^{-1}\left[\frac{1}{(s-1)(s+2)}\right]$

(iii) $L^{-1}\left[\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right]$

4. Solve the differential equation by Laplace Transform method.

(i) $y'' - 3y + 2y = 4t + e^{3t}$ where $y(0) = 1$ and $y'(0) = -1$

(ii) $(D^2 + 2D + 1)y = t$, where $y(0) = -3$ and $y'(1) = -1$

(iii) $(D^2 - 2D + 1)x = e^t$ where $x(0) = 2$ and $x'(0) = -1$

(iv) $(D^2 + 9)y = 18t$, with $y(0) = 0$ and $y'\left(\frac{\pi}{2}\right) = 1$

5. Solve the simultaneous equation by Laplace Transform method

(i) $\frac{dx}{dt} + 5x - 2y = t$ with $y = 0 = x$ when $t = 0$

$\frac{dy}{dt} + 2x + y = 0$

(ii) $\frac{dx}{dt} - 5y = e^t$ given $x(0) = 1$, $y(0) = 1$

$\frac{dy}{dt} + x = \sin t$

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