ABES Engineering College, Ghaziabad

Department of AS&H

Session: 2023-24 **Semester:** II **Section:** All

Course Code: BAS-203 **Course Name:** Engg. Maths-II

Tutorial-3 (Laplace Transform)

S.No.	KL, CO	Question
1	K3, CO2	Find the Laplace transform of following F(t) $(i)\begin{cases}1, & 0 \le t < 1\\ t, & 1 \le t < 2\\ t^2 & 2 \le t < \infty\end{cases}$ (ii) $t^2 e^t sin4t$ (iii) $\begin{cases}e^{t-a}, & t > a\\ 0, & t < a\end{cases}$ (iv) $\int_0^t e^{-t} cost\ dt$
2	K3, CO2	Evaluate $(a)\ \int_0^\infty t^3 e^{-t} sint\ dt$ $b)\int_0^\infty \frac{cos6t-cos4t}{t} dt$
3	K3, CO2	*Find the Laplace Transform of* $(t-1)^2 u(t-1)$
4	K3, CO2	*Show that:* $\int_0^\infty e^{-2t}\left(\frac{2sint-3sinht}{t}\right) = 2\cot^{-1}(2) + \frac{3}{2}\log\left(\frac{1}{3}\right)$
5	K3, CO2	*Express the following functions in terms of unit step function and find its Laplace transform:* $(a)\ L[F(t)] = \begin{cases}t^2, 0 < t \le 2\\ 4t, & t > 2\end{cases}$ $(b)L[e^{-t}\{1-u(t-2)\}$
6	K3, CO2	*Find L.T. of full rectified sine wave defined by the expression* $\begin{cases}sin\ t, & 0 < t < \pi\\ -\sin t, & \pi < t < 2\pi\end{cases}$
7	K3, CO2	*Find the Inverse Laplace transform of the following:* $(a)\frac{72}{p^5} - \frac{3\sqrt{\pi}}{2p^{5/2}} + \frac{6}{p}$ $(b)\frac{p^2+1}{p^3+3p^2+2p}$ $(c)\frac{5e^{-p}}{p} - \frac{e^{-p}}{p}$ $(d)\frac{p}{(p+1)^2(p^2+1)}$
8	K3, CO2	*State convolution theorem for the inverse Laplace Transform. Hence find the inverse Laplace Transform of the function* $\frac{8p}{(p^2+1)^2(p^2+16)}$

9	K4, CO2	*A particle moves in a line so that its displacement x from a fixed point O at any time t, is given by* $\frac{d^2x}{dt^2}+4\frac{dx}{dt}+5x=80 \sin 5t$. *Using L.T., find its displacement t any time t if initially particle is at rest at x=0.*
10	K3, CO2	$2\frac{dx}{dt}+\frac{dy}{dt}-x-y=e^{-t}, \frac{dx}{dt}+\frac{dy}{dt}+2x+y=e^{t}$, *y(0)=1,x(0)=2.*

Answers:

1 *(a)* $\frac{1}{p}+\frac{2}{p}e^{-2p}+\frac{e^{-p}}{p^2}+\frac{3}{p^2}e^{-2p}+\frac{2}{p^3}e^{-2p}$ *(b)* $8\frac{(3p^2-6p-13)}{(p^2-2p+17)^3}$ *(c)* $\frac{e^{-ap}}{p-1}, p>1$ *(d)* $\frac{p+1}{p(p^2+2p+2)}$

2 *(a) 0 (b)* $log\frac{2}{3}$

3 $2\frac{e^{-p}}{p^3}$

4 PT

5 (a) $\frac{2(1-e^{-2p})}{p^3}+\frac{4e^{-2p}}{p}$ *(b)* $\frac{1}{(p+1)}-\frac{e^{-2(p+1)}}{p+1}$

6 $\frac{1+e^{-\pi p}}{(1-e^{-\pi p})(p^2-1)}$

7 (a) $3t^4-2t^{3/2}+6$ $(b)\frac{1}{2}-2e^{-t}+\frac{5}{2}e^{-2t}$

$(c)5u(t-3)-u(t-1)$ $(d)\frac{1}{2}(sint-te^{-t})$

8 $\frac{60tsint-8cost+8cos4t}{225}$

9 $x=e^{-2t}(2\cos t+14 \sin t)-2\cos 5t-2\sin 5t)$

10 x=2cost+8sint, y=cos t -13sin t +sinh t