Assignment IN_40Q

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Question

The signal $x(t) = (t-1)^2 u(t-1)$,where u(t) is unit-step function,has the Laplace transform X(s).The Value of X(1) is

1) $\frac{1}{e}$
2) $\frac{2}{e}$
3) $2e$
4) e^2

(GATE 2022 IN 40)

Solution:

PARAMETER	VALUE	DESCRIPTION
$x(t)$	$x(t) = (t-1)^2 u(t-1)$	Function
$X(s)$	$X(s) = \frac{2e^{-s}}{s^3}$	laplace transform of x(t)

TABLE I
INPUT PARAMETER TABLE

$$x(t) = (t-1)^2 u(t-1) \tag{1}$$

Taking Laplace-Transform:

$$t^n u(t) \leftrightarrow \frac{n!}{s^{n+1}} \tag{2}$$

if $X(s)$ is Laplace transform of $x(t)$ then,

$$x(t-t_0) = e^{-st_0} X(s) \tag{3}$$

using 2 and 3

$$(t-1)^2 u(t-1) \leftrightarrow \frac{2e^{-s}}{s^3} \tag{4}$$

$$X(s) = \frac{2e^{-s}}{s^3} \tag{5}$$

$$X(1) = \frac{2}{e} \tag{6}$$

$\therefore$ 2 is Correct.

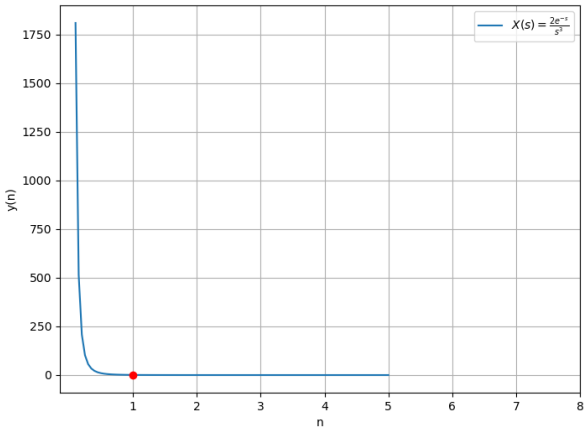

Fig. 1. X(s) = $2e^{-s}/s^3$