

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:

$$x(t) = (t - 1)^2 u(t - 1) \quad (1)$$

Taking Laplace-Transform:

$$\mathcal{L}\{u(t)\}$$

$$u(t) L \frac{1}{s} \quad (2)$$

$$\mathcal{L}\{tu(t)\}$$

$$tu(t) L \frac{1}{s^2} \quad (3)$$

\vdots

$$\mathcal{L}\{t^n u(t)\}$$

$$t^n u(t) L \frac{n!}{s^{n+1}} \quad (4)$$

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

$$x(t - t_0) = e^{-st_0} X(s) \quad (5)$$

using ?? and ??

$$\mathcal{L}\{tu(t)\}$$

$$(t - 1)^2 u(t - 1) L \frac{2e^{-s}}{s^3} \quad (6)$$

$$X(s) = \frac{2e^{-s}}{s^3} \quad (7)$$

$$X(1) = \frac{2}{e} \quad (8)$$

\therefore 2 is Correct.