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DEPARTMENT OF MATHEMATICS

UNIT-I APLACE TRANSFORMS Londibions TNTRODUCTION : (1) f(t) should be continuous or à statu Laplace Transformation , amamed after a great French Mathematician Pierre Sinton De Laplace (1749-1827) Who used such transformations in the " Theory of probability" Said to be runction fless is Uses of Laplace Transformation: order il 1. It is used to find the solution of linear differential equations - ordinary as well as partial. a. It helps in solving the differential equation with boundary values without finding the general solution and then finding the values of the arbitrary constants Transformation ; A transformation is an operation which converts to a different but 5172 equivalent form. infrai Laplace Transformation : Definition : Stu s Let f(t) be a function of t defined for t>0 Then the Laplace transform of f(t), denoted by 1 & f(t) } or F(s) is defined by, $L [f(t)] \xrightarrow{d_2} \int e^{-st} f(t) dt \xrightarrow{d_1} F(s) \xrightarrow{d_1}$ Provided the integral exists. °° . = is not of exponential order





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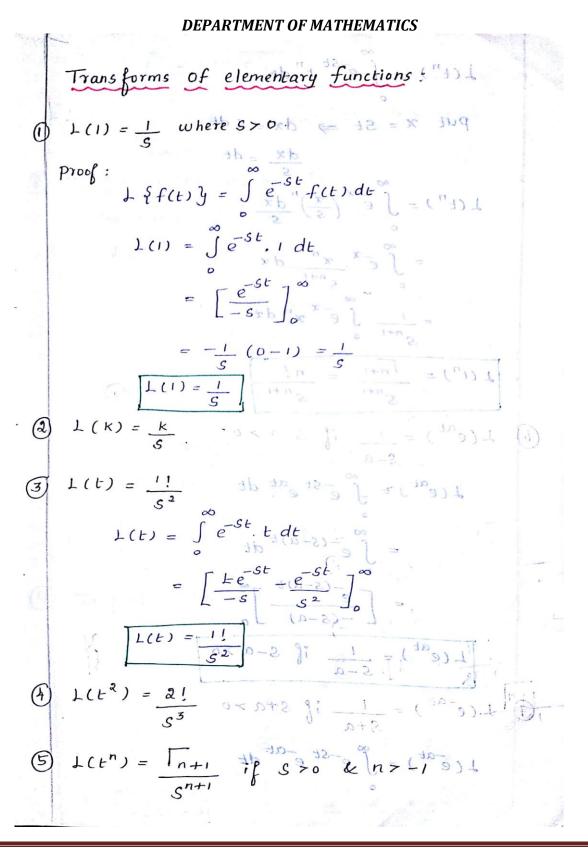
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Conditions for existence of Laplace transform: (i) f(t) should be continuous or piecewise continuous in the given closed interval [a,b] where a>o (ii) f(t) should be of exponential order. Exponential order : (1349-1827) who used asach A function -f(t) is said to be of exponential order if linean differential countrars ordinars $e^{\pm 4}$ well as partial It helps in sating the differential costants 5 $Lt = \frac{1}{E \to \infty} e^{-St} f(t) = Lt = \frac{1}{E \to \infty} e^{-St} t^{2}$ on is an operation which converts $t = \frac{t}{2}$ $t = \frac{t}{2}$ form = Lt 2t notinifa to setstant apply L Hospito est top benifest d'is not of exponential order. z = 0 $t \to \infty$ $s^2 e^{st} = \frac{2}{2} = 0$ $z \to 0$ $s^2 e^{st} = \frac{2}{2} = 0$ $z \to \infty$ $s^2 e^{st} = \frac{2}{2} = \frac{$ $\begin{array}{ccc} Lt & -st \\ t \rightarrow \infty \end{array} f(t) = 0 \ Lt \quad e^{-st} e^{t^2} \\ t \rightarrow \infty \end{array}$ E-> 0 C = e[®] = 0 is not of exponential order.





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DEPARTMENT OF MATHEMATICS L(tn) = oilsie t tradtanois to simplement put $x = St \implies dx = Sdtation \frac{1}{2} = (1)$ $L(t^{n}) = \int_{e}^{\infty} \frac{dx}{\left(\frac{x}{s}\right)^{n}} \frac{dx}{s} = \{(y)\}\} dx$ $\int e^{-x} \cdot \frac{x^{n+b}}{s^{n+b}} dx = (1) ($ $\frac{1}{S^{n+1}}\int_{0}^{\infty}e^{-\chi}\chi^{n}d\chi$ $\mathcal{L}(t^{n}) = \frac{\int_{n+1}^{n+1} \frac{2}{s^{n+1}}}{s^{n+1}} = \frac{n!}{s^{n+1}}$ $L(e^{at}) = \frac{1}{s-a} \quad \text{if } s-a > 0 \quad \frac{1}{s} \quad (1) \quad (1)$ 6 $\mathcal{L}(e^{\alpha t}) = \int_{e}^{\infty} e^{-st} e^{\alpha t} dt$ $=\int_{0}^{\infty}e^{-(s-a)t}dt = (3)t$ $= \int \frac{e^{-(s-a)t}}{e^{-(s-a)t}} \int_{a}^{\infty}$ $L(e^{at}) = \frac{1}{s-a} \quad \text{if } s-a > 0$ $(\overline{4}) \perp (e^{-at}) = \frac{1}{S+a} \quad \text{if } S+a > 0$ $L(e^{-at}) = \int_{0}^{\infty} e^{-st} e^{-at} dt \qquad ("1) dt$





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$$= \int_{a}^{\infty} e^{-(s+a)t} dt : (1a \ bas) \ bas = bas = bas} dt = bas = bas} dt = bas} dt = bas = bas} dt =$$