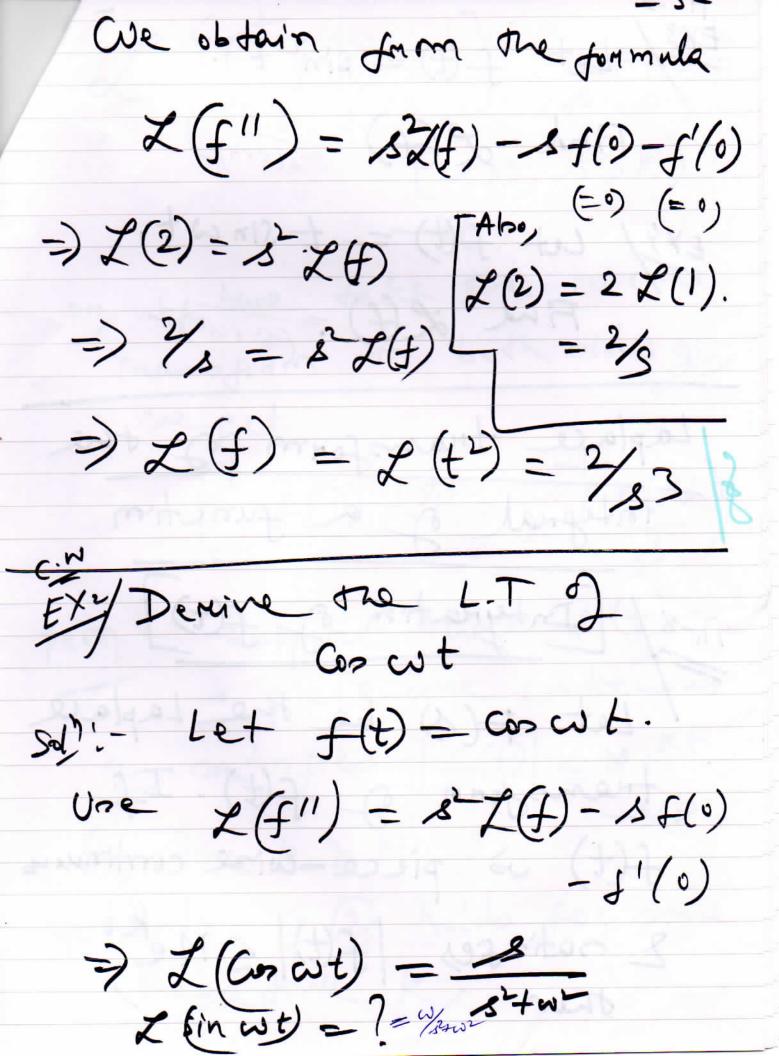
Dalt Lecture 4
25/03/2017 In-7/ (Laplace Transform of the dereivative geny th Let f(t) & its Lenirating f'(t), f"(t), ..., f(-1)(t) be continuous for all +70, natigy | ft) | LMe for some k & M , & let the derivative on (t) be piece-wire continuous m every finite intermal in the mange + >0. Then the

Then the Laplace transform  $f^{n}(t) \text{ exists when}$  5>k & is finen by  $f(f(0)) = s^{n} f(0) - s^{n-1} f(0)$   $- s^{n-2} f'(0) f(-1) (0)$ 

Ext/ Let  $f(t) = t^2$ . Denive  $f(t) = t^2$ . Denive  $f(t) = t^2$ . Denive  $f(t) = t^2$ . f(0) = 0 f(t) = 2t, f'(0) = 0f''(t) = 2



Ex3/ Let f(t) = sin2t. Find 2(f) = 2 (8244) Exy Let f(t) = t sin wt.

Find L(f) = 2005

(52+027)2 Laplace transform of the integral of a function Th-8/ [Internation of f(t)] Let F(s) be the Laplace transform of f(t). If f(t) so piece-wise continuous 2 notinges |f(t)| < Mekt

 $Z\left(\int_{0}^{t} f(0) dT\right) = \frac{1}{s} F(s)$ (3>0,3>K) on, it we take the inverse transform on both sides go cre get  $\int_{0}^{t} f(r) dr = \int_{0}^{\infty} \left( \frac{F(s)}{F(s)} \right)$ priori :- Suppose that f (t) à piece-coire continuous 2 natinfies |f(t)| < Mekt for some K2M. Clearly, if @ holds for some negative K,

it also holds for positive k en nay assume. Then the integral g(t) = (t) L(1) L(1 2) continuous, 2 by usity

(2) continuous, 2 by usity

(EXX) b tou'n

(EXX) b tou = M (ekt -1) [: k>0 +>0

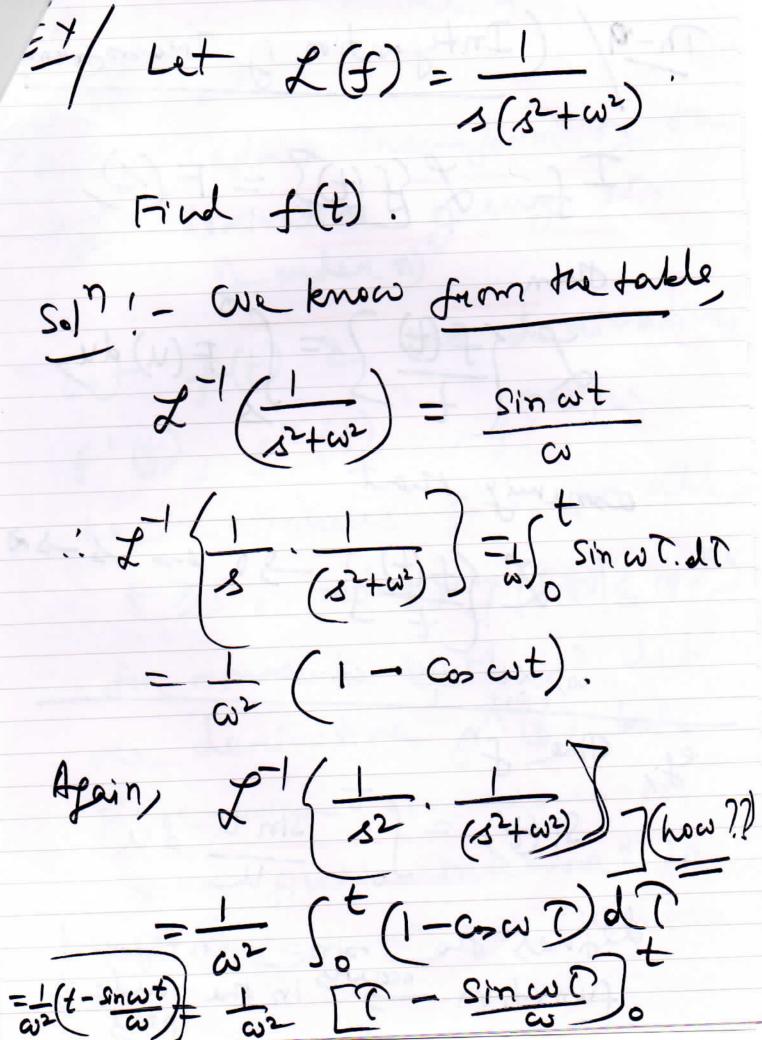
K+>0

K+>0

K+>0

Kk-1>0

This shows that g(t) also satisfies an inequality of the form 2 Alog g'(t) = f(t)[ mis is known as the Fundamental theorem gre Calmbus] except for points at which f(t) à discontinuous. Hence gl(t) is piece-coire continuous on each suite internal & by th-2 L(f(t)) = L(f(t)) = 15 2 (f(t)] - f()(s)k) Hence, cleanly f(0) = 0 (how!) so that L(f) = 1 L(f) => L(f) = L(f)  $=\int Z\left(\int_{S}^{S} f(r)dr\right) = \frac{F(s)}{s}$ => (t) dT = 2 (F(s))



FR

In-19/ (Integnation of Treamsforms) If 2(4)3 = F(3) 2 (f(t)) = (F(W) du) amunity ment 又(+(t)) -30 an s-30 on, xt f(t) exists. eg, one on Si(t) = St sinu du function sine in the study of