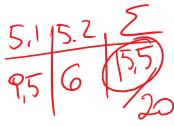




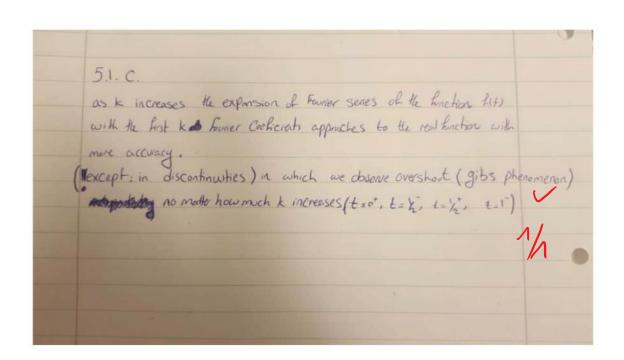
Exercise Sheet 5



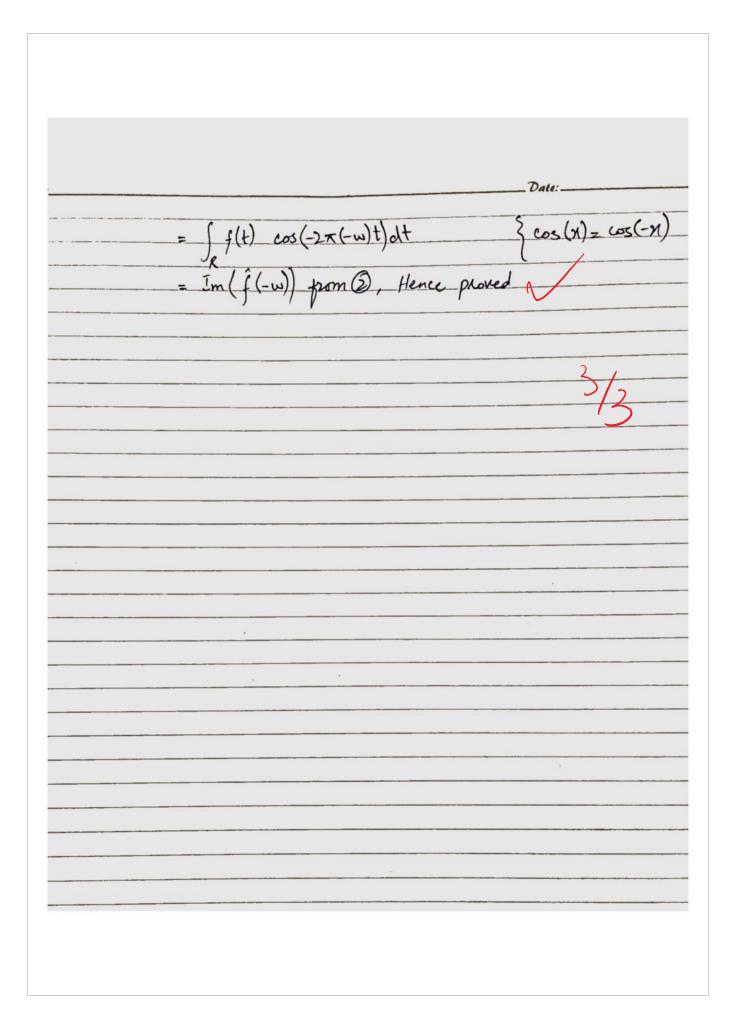
Group Members:

Muhammad Ahmed (3304158) Cüneyt Erem (3277992) Ali Mohammadi (3289515) Rozhin Bayati (3314202)

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5.1. a.	0
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(flbk), JZ (sin 201kt dt + f-sin201kt dt), JZ (sin2	(TILE) CS 2016 - GS 714
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Foundations of Audio Signal Processing Exercise 5 Date: 16.11.2019
Exercise 5.2: If $f \in L^2(\mathbb{R})$ then $\hat{f}(w) = \int_{\mathbb{R}} f(t) e^{-2\pi i w t} dt$
a) If f is imagnissy, then $Re(\hat{f})$ is odd and $Im(\hat{f})$ is even.
$f(w)$, $f(t)e^{-2\pi i ut} dt$
JR SEWLEU'S
= \int f(t) (cos (-2xwt) + i sin(-2xwt)) alt \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
$= \int_{R} f(t) \left(\cos \left(-2\pi \omega t\right) + i \sin \left(-2\pi \omega t\right)\right) dt $ $= \int_{R} f(t) \cos \left(-2\pi \omega t\right) dt + i \int_{R} f(t) \sin \left(-2\pi \omega t\right) dt$ Since f is imprainable.
Since f is imaginary,
$Re(\hat{f}(\omega)) = i \int_{\mathcal{B}} f(t) \sin(-2\pi\omega t) dt$ (1)
R
To prove $Re(\hat{f}(w))$ odd, we need to show $Re(\hat{f}(w)) = Re(-\hat{f}(w))$, then consider
The state of the s
$Re(\hat{f}(w))=i\int_{e}^{\infty}f(t)(-\sin(-2\pi(-w)t))dt$
: 1 ((1) () () () ()
$=-i\int_{R}f(t)\sin(-2\pi(-\omega)t)dt$
= Re(-f(-w)), from D, Hence proved.
$Im(\hat{f}(w)) = \int_{\mathcal{R}} f(t) \cos(-2\pi wt) dt $
To prove $\operatorname{Im}(\hat{f}(\omega))$ even, we need to show $\operatorname{Im}(\hat{f}(\omega)) = \operatorname{Im}(\hat{f}(-\omega))$, then consider
Im $(\hat{f}(\omega))$ = $\int_{R} f(t) \cos(-(-2\pi(-\omega)t)) dt$
Je de la companya della companya della companya de la companya della companya del



b) It to imaginary and even, I is imaginary on decen We know that f(w)= 11(+)-e-2014 dt = f(t). (0)(-204+)++ iff(4).511(-204+)d+ becare fix impray > imaginar if fit imaging and eur, then real port should be 0, Relfl(a) =0 Re(f)(w) = 1. f(+) sin (-2 rue) d+ 1. f(4) . sin(-2 rue) d+ they are 2 different things == iff(-4). sin(-2nu(-4)/+4)+1. ff(4) sin(-2nut)d+ freur i. If 6) mil-non (+1) by +i Selt son (-north) dt - 51 13 odd = 1. Stat). - 51 (-2 nat) 4 + i- Stabin (-2 nut) + one not the = For Helsin (-9nweld+ + f-foll) and-2nu+ld+ =0 c) fit imaging and old, fit real and old? Im (1)(W)=0 = (f(4) cos (-2nn+) d+ it f(4) cos(-2nn+) d+ slaved substille -t also in the = (f(-+) cos (-2aul-+))(-d+)+ ff(+). cos (-2au+)d+ Scarch park fireblicospecial f-f(+), + cos(-2nut)d+ + Sf(+) cos(-2nut)d+ - If (+).cos (-?nu+)d+ + If(+)cos (-2nu+)d+ =0