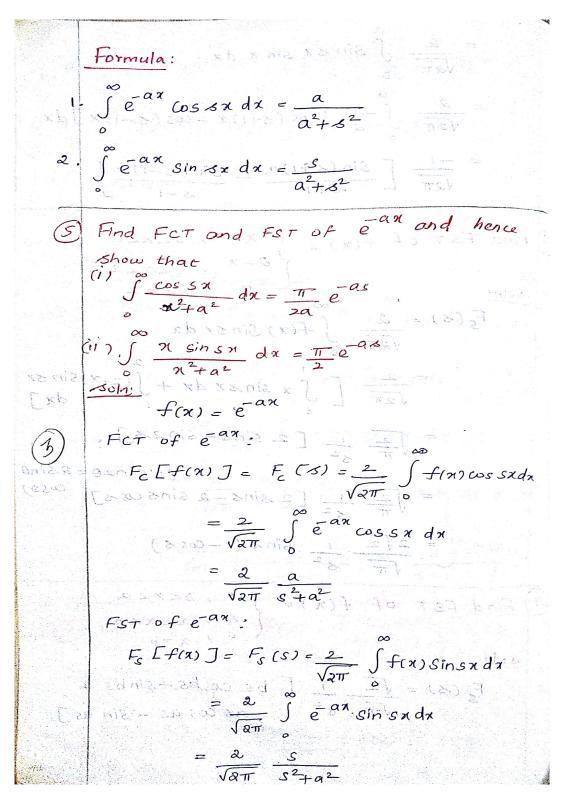




SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

DEPARTMENT OF MATHEMATICS



FOURIER TRANSFORMS



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(i) Using inverse Fourier cosine transforms,

$$f(x) = \frac{2}{\sqrt{a\pi}} \int_{0}^{\infty} F_{c}(x) \cos \sigma x \, ds$$

$$= \frac{2}{\sqrt{a\pi}} \int_{0}^{\infty} \frac{2}{\sqrt{a\pi}} \frac{a}{\alpha^{2} + \sigma^{2}} \cos \sigma x \, ds$$

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$$= \frac{2}{\sqrt{a\pi}} \int_{0}^{\infty} \frac{2}{\sqrt{a\pi}} \frac{a}{\alpha^{2} + \sigma^{2}} \, ds$$
($x \leftrightarrow 5$).
(ii) Using inverse Fourier Sine transforms,

$$f(x) = \frac{2}{\sqrt{a\pi}} \int_{0}^{\infty} F_{s}(s) \sin \sigma x \, ds$$

$$= \frac{e^{-ax}}{\sqrt{a\pi}} \int_{0}^{\infty} \frac{2}{\sqrt{a\pi}} \frac{s}{\sigma^{2} + a^{2}} \sin \sigma x \, ds$$

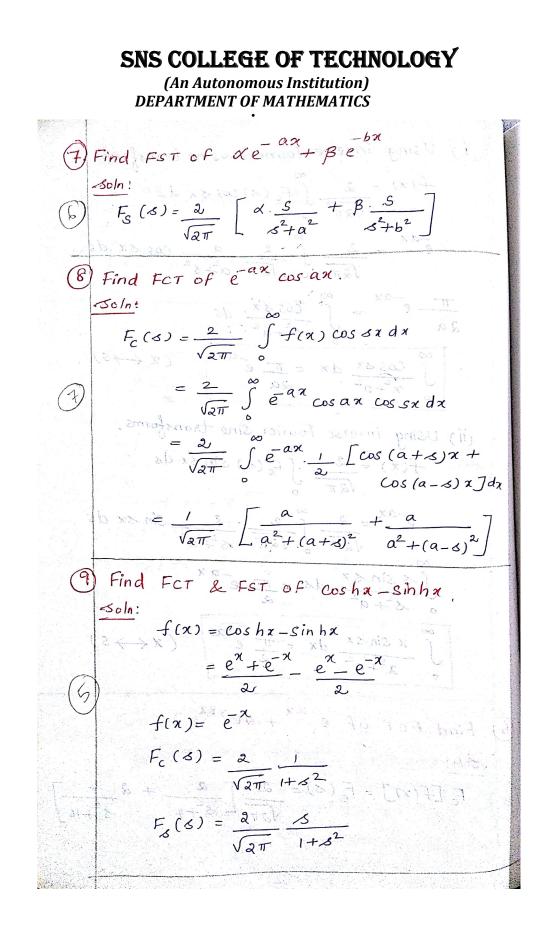
$$\int_{0}^{\infty} \frac{s \sin \sigma x}{\sigma^{2} + a^{2}} \, ds = \frac{\pi}{2} e^{-ax}$$
($x \leftrightarrow s$).
(b) Find Fert of $e^{-2x} + 2e^{-4x}$

$$F_{c}[f(x)] = F_{c}(\sigma) = \frac{2}{\sqrt{a\pi}} \left[\frac{a}{\sigma^{2} + 4} + \frac{a}{\sigma^{2} + 16} \right]$$

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Page 2







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(*) Evaluate
$$\int_{0}^{\infty} \frac{dx}{(x^{2}+a^{2})^{2}}$$

soln:
Take $f(x) = e^{-ax}$
(*) $F_{c}[f(x)] = F_{c}(s) = \frac{2}{\sqrt{2\pi}} \cdot \frac{a}{a^{2}+s^{2}}$
Using passeval's identity,
 $\int_{0}^{\infty} [f(x)]^{2} dx = \int_{0}^{\infty} [f(x)]^{2} ds$
 $\int_{0}^{\infty} (e^{-ax})^{2} dx = \int_{0}^{\infty} [f(x)]^{2} ds$
 $\int_{0}^{\infty} e^{-aax} dx = \int_{0}^{\infty} \frac{1}{2\sqrt{2\pi}} \cdot \frac{a^{2}}{a^{2}+s^{2}} ds$
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 $\int_{0}^{\infty} (a^{2}+a^{2})^{2} dx$
 $f(a^{2}+a^{2})^{2} dx$
 $f(a^{2}+a^{2})^{2} dx$
(*) Evaluate $\int_{0}^{\infty} \frac{x^{2}}{(x^{2}+a^{2})^{2}} dx$
 $f(x) = e^{ax}$
 $f(x) = e^{ax}$

Using panseval's identity for Fourier
Sine transforms,

$$\int [f(x)]^{2} dx = \int [F_{5}(f(x))]^{2} ds$$

$$\int (e^{-\alpha x})^{2} dx = \int \frac{4}{2\pi} \cdot \frac{z^{2}}{(s^{2}+a^{2})^{2}} ds$$

$$\frac{1}{2a} \cdot \frac{\pi}{2} = \int \frac{g}{(s^{2}+a^{2})^{2}} ds$$

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$$\frac{1}{2a} \cdot \frac{g}{(x^{2}+a^{2})^{2}} dx = \frac{\pi}{4a}$$

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$$\frac{1}{2a} \cdot \frac{g}{(x^{2}+a^{2})$$

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$$\frac{1}{3} \cdot \frac{\pi}{2} = \int_{0}^{\infty} \frac{s^{2}}{(s^{2}+4)(s^{2}+1)} ds$$

$$Put \quad s = x \implies ds = dx.$$

$$\int_{0}^{\infty} \frac{x^{2}}{(x^{2}+4)(x^{2}+1)} dx = \frac{\pi}{b}$$

$$(3) \quad \text{Evaluate} \quad \int_{0}^{\infty} \frac{dx}{(x^{2}+a^{2})(x^{2}+b^{2})}$$

$$(1) \quad soln:$$

$$I = \frac{\pi}{2ab(a+b)}$$

$$(1) \quad \text{Evaluate} \quad \int_{0}^{\infty} \frac{x^{2} dx}{(x^{2}+a^{2})(x^{2}+b^{2})}$$

$$(2) \quad \text{Soln:}$$

$$I = \frac{\pi}{2(a+b)}$$

$$(3) \quad \text{Find } FST \quad of \quad \frac{\pi}{a^{2}+a^{2}}$$

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$$(3) \quad \text{Using inverse Fourier Sine transforms,}$$

$$f(x) = \frac{2}{\sqrt{2\pi}} \quad \int_{0}^{\infty} \frac{f_{S}(s) \sin sx}{(2\pi)} ds$$

$$e^{-ax} = \frac{2}{\sqrt{2\pi}} \quad \int_{0}^{\infty} \frac{s}{(2\pi)} \quad \frac{sin sx}{s^{2}+a^{2}}$$

$$e^{-ax} = \frac{4}{2\pi} \quad \int_{0}^{\infty} \frac{s}{s^{2}+a^{2}} \quad \text{Sin } sx \, ds$$

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