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SNS COLLEGE OF TECHNOLOGY

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USINOI PERSEVAL'S PROBLEMS FOURIER SINE TRANSFORM COSINE TRANSFORM FOURIER SF8 (3) Cr8 (5) ds = Sfcaga) dx where FSCS) = FS [fcx] GS(S) = Fg [g(x)]

SFC(E) GC(E) ds = Spang(x) dx where Fc (3) = Fc [q(x)] Evaluate $\int_{(x^2+a^2)(x^2+b^2)}^{\infty} \frac{dx}{(x^2+a^2)(x^2+b^2)}$ Polution: Since the numerator in the integrant is de me use tourier cosine transform. Since denominator (22+22)(x2+62) take f(x) = e-ax; q(x) = e-bx FC(s) = FC[fG] $= \int_{\frac{\pi}{2}} \int_{0}^{\infty} f(x) \cos x dx$

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$$F_{C}(g) = \sqrt{\frac{2}{37}} \frac{a}{a^{2}+s^{2}}$$

Similarly

Parseval's Identity in Houses cosine transform

$$\int_{0}^{\infty} F_{C}(g) \cdot F_{C}(g) \cdot G_{S}(g) \cdot G_{S}($$



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Ret
$$S=\infty$$
; $dS=d\infty$

$$\int_{(x^2+a^2)}^{\infty} \frac{dx}{(x^2+a^2)} = \frac{\pi}{2ab}(a+b)$$

(a) Evaluate
$$\int_{(x^2+a^2)}^{\infty} \frac{dx}{(x^2+a^2)} = \frac{\pi}{2a^2+b^2}$$
; $a>0$; $b>0$

Solution:

Since the numerator of the integrant is x^2dx , so we the Fourier sine transform.

Denominator is $(x^2+a^2)(x^2+b^2)$

Take $f(x) = e^{-ax}$; $g(x) = e^{-bx}$

$$F_S(S) = F_S [f(a)]$$

$$= \int_{\pi}^{\infty} \int_{0}^{\infty} f(x) \sin sx \, dx$$

$$= \int_{\pi}^{\infty} \int_{0}^{\infty} e^{-ax} \sin sx \, dx$$



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Rouseval's Identity in Fourier sine transforms

$$\int_{0}^{\infty} F_{S}(s) G_{1S}(s) ds = \int_{0}^{\infty} f(s) g(s) ds$$

$$\int_{0}^{\infty} \frac{S}{a^{2}+S^{2}} \int_{0}^{\infty} \frac{S}{s^{2}+b^{2}} ds = \int_{0}^{\infty} e^{-ax} \int_{0}^{-ba} dx$$

$$\int_{0}^{\infty} \frac{S}{a^{2}+S^{2}} \int_{0}^{\infty} \frac{S}{s^{2}+b^{2}} ds = \int_{0}^{\infty} e^{-(a+b)a} dx$$

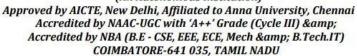
$$\int_{0}^{\infty} \frac{S}{a^{2}+S^{2}} \int_{0}^{\infty} \frac{S}{s^{2}+b^{2}} ds = \int_{0}^{\infty} e^{-(a+b)a} dx$$

$$\int_{0}^{\infty} \frac{S}{(a+b)} \int_{0}^{\infty} \frac{S}{(a+b)} \int_{0}^{\infty} \frac{S}{(a+b)} \int_{0}^{\infty} \frac{S}{(a+b)} \int_{0}^{\infty} \frac{S}{(a+b)} \int_{0}^{\infty} \frac{S}{(a+b)^{2}} ds$$

$$\int_{0}^{\infty} \frac{S}{(a^{2}+a^{2})^{2}} \int_{0}^{\infty} \frac{S}{(a^{2}+a^{2})$$



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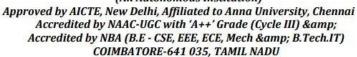




Solution: numerator Use cosine transform. Denominator is (x2+ a2)2 = (22+a2)(x2+a2) Here f(x) = e-asc; q(x) = e Fc(s) = Fc[f(x)] = 1 fca) cos sa da $= \int_{\pi}^{2} \int_{-\infty}^{\infty} e^{-\alpha x} \cos sx \, dx$ Idenditity, in transform Fe (3) by (3) ds



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$$\int_{0}^{\infty} \int_{0}^{2\pi} \frac{a}{a^{2}+s^{2}} \int_{0}^{2\pi} \frac{a}{a^{2}+s^{2}} ds = \int_{0}^{\infty} e^{-2\alpha x} da$$

$$\int_{0}^{2\alpha^{2}} \int_{0}^{\infty} \frac{ds}{a^{2}+s^{2}} \int_{0}^{2\pi} e^{-2\alpha x} da$$

$$= \left[\underbrace{e^{-2\alpha x}}_{-2\alpha} \right]_{0}^{\infty}$$

$$\int_{0}^{2\pi} \frac{ds}{(a^{2}+s^{2})^{2}} = \underbrace{1}_{2\alpha}$$

$$\int_{0}^{2\pi} \frac{ds}{(a^{2}+s^{2})^{2}} = \underbrace{1}_{2\alpha}$$

$$\int_{0}^{2\pi} \frac{ds}{(s^{2}+a^{2})^{2}} = \underbrace{1}_{2\alpha}$$
Since the numerator of the integrant is $\underbrace{a^{2}dx}_{-2\alpha}$ use use sine transform

$$\int_{0}^{2\pi} \frac{ds}{(x^{2}+a^{2})^{2}} = \underbrace{(x^{2}+a^{2})(x^{2}+a^{2})}_{-2\alpha}$$
Take $\underbrace{f(x)}_{-2\alpha} = \underbrace{e^{-\alpha x}}_{-2\alpha}$

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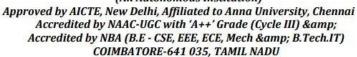
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$$= \int_{\overline{J}}^{2} \int_{0}^{\infty} e^{-\alpha x} \sin sx \, dx$$

Similarly,

Parseval's Identity in Fourier sine transforms

$$\int_{0}^{2} \int_{0}^{2} \frac{s}{a^{2}+s^{2}} \int_{0}^{2} \frac{s}{s^{2}+a^{2}} ds = \int_{0}^{2} e^{-ax} e^{-ax} dx$$

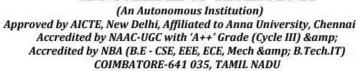
$$\frac{2}{37} \int_{0}^{\infty} (a^{2}+5^{2})(a^{2}+5^{2}) ds = \int_{0}^{\infty} e^{-2ax} dx$$

$$= \begin{bmatrix} e^{-2\alpha} & \sqrt{3} & \sqrt{3} \\ -2\alpha & \sqrt{6} & \sqrt{6} \end{bmatrix}$$

$$= D - \left(\frac{1}{-2\alpha}\right)$$

$$\frac{2}{\pi} \int_{0}^{\infty} \frac{g^{2}}{(s^{2}+\alpha^{2})^{2}} ds = \frac{1}{2\alpha}.$$







$$\int_{0}^{\infty} \frac{S^{2}}{(S^{2}+\alpha^{2})^{2}} ds = \frac{1}{4\alpha}$$

$$\int_{0}^{\infty} \frac{x^{2} dx}{(x^{2}+\alpha^{2})^{2}} = \frac{JI}{4\alpha}$$