SRM Institute of Science and Technology
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Department of Mathematics
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Course Code &Title: 18MAB201T-Transforms and Boundary Value Problems

Year &Sem: II/III , Unit: IV

Tutorial 2

Part A

1	Define infinite complex Fourier cosine and Fourier sine transform of $f(x)$ and write their inversion formula.
2	Write down the corresponding Kernels in the above formulas.
3	Write down the expressions for $F_c[xf(x)]$ and $F_s[xf(x)]$.
4.	If $F_c[f(x)] = F_c(s), F_c[g(x)] = G_c(s), F_s[f(x)] = F_s(s)$ and $F_s[g(x)] = G_s(s)$ then show that $F_c[a.f(x) + b.g(x)] = a.F_c(s) + b.G_c(s)$ and $F_s[a.f(x) + b.g(x)] = a.F_s(s) + b.G_s(s)$.
5.	If $F_c[f(x)] = F_c(s)$ and $F_s[f(x)] = F_s(s)$ then write down the expressions for $F_c[f(x)\cos(ax)], F_s[f(x)\cos(ax)], F_c[f(x)\sin(ax)], F_s[f(x)\sin(ax)], F_c[f(ax)]$ and $F_s[f(ax)]$.
6.	Fill in the blanks: $\int_0^\infty F_c(s)G_c(s)ds =$ _____, $\int_0^\infty F_s(s)G_s(s)ds =$ ____, $\int_0^\infty \|F_c(s)\|^2 ds =$ ____ and $\int_0^\infty \|F_s(s)\|^2 ds =$ ____ .

Part B

7.	Find the Fourier sine transform of $f(x) = \frac{1}{x}$.
8.	Find the Fourier cosine transform of $$f(x) = \begin{cases} \cos(x), & 0 < x < a \\ 0, & x > a \end{cases}.$$
9.	Find the Fourier cosine and sine transforms of $$f(x) = e^{-ax}, a > 0$$ And hence evaluate $$\int_0^\infty \frac{s}{a^2+s^2}\sin(sx)\,ds \text{ and } \int_0^\infty \frac{1}{a^2+s^2}\cos(sx)\,ds.$$
10.	Evaluate the values of $$\int_0^\infty \frac{dx}{(a^2+x^2)(b^2+x^2)} \text{ and } \int_0^\infty \frac{dx}{(a^2+x^2)^2}.$$
11.	Find the expressions for $$F_s[xf(x)] \text{ and } F_c[xf(x)].$$
12.	Find Fourier cosine transform of $e^{-a^2x^2}$ and hence evaluate the Fourier sine transform of $xe^{-a^2x^2}$.
13.	Find the expression for $f(x)$ from the integral equation

	$\int_0^{\infty} f(x)\sin(sx)\,dx = \begin{cases} a, & 0 \le s < 1 \\ b, & 1 \le s < 2 \\ c, & s \ge 2 \end{cases}$
14.	Define the Dirac Delta function $\delta(x-a)$ and find its Fourier transformation.