Sandip Foundation's
Sandip Institute **of Technology & Research Centre, Nashik**
S. E. III : Mathematics
UNIT 2 : PART I : Assignment II : Fourier Transform

Q.1. Find the Fourier transform of the following functions :

(i) $f(x) = \sin x \ , \ 0 < x < \pi$
$= 0$, otherwise.

(ii) $f(x) = \sin x \ , \ 0 < x < \pi$
$= 0$, otherwise.

Q.2. Find the sine and cosine transforms of :

$f(x) = x \ , \quad 0 \le x \le 1 ,$
$= 2 - x \ , \ 1 \le x \le 2$
$= 0 \ , \quad x \neq 0$

Q.3. What is the function f (x) whose Fourier cosine transform is $\frac{\sin a x}{x}$?

Q.4. Find the inverse sins tran sform of $\frac{e^{-aD}}{D}$.

Q.5. Find the Fourier transform of $f(x) = 1 - x^2 \ , \ |x| \le 1 ,$
$= 0 \ , \ |x| \neq 1 .$

Hence evaluate $\int_0^\infty \left(\frac{x \cos x - \sin x}{x^3} \right) \cos \frac{x}{2} \, dx.$

Q.6. Find the Fourier integral representation of $f(x) = 1 \ , \ |x| \ge a$
$= 0 \ , \ |x| \neq a$

and hence show that $\int_0^\infty \frac{\sin a x}{x} \, dx = \frac{\pi}{2}$.

Q.7. Using Fourier integral representation , show that

$$\int_0^\infty \frac{\lambda^3 \sin \lambda x}{\lambda^4 + 4} \, dx = \frac{\pi}{2} e^{-x} \cos x \ (x \neq 0)$$

Q.8. Solve the following intrgral equations :

(i) $\int_0^\infty f(x) \sin \lambda x \, dx = 1 \ , \ 0 \le x \ge 1$
$= 2 \ , \ 1 \le \lambda \ge 2$
$= 0 \ , \ \lambda \ge 2.$

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(ii) $\int_0^\infty f(x) \cos \lambda x \, dx = 1 - \lambda \ , \ 0 \le \lambda \ge 1$

$= 0 \ , \ \lambda \ge 1$