Course - B.Sc Physics (Hons)

Semester - IV

Paper Name - Mathematical Physics III

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Instructions to the Students

① I am continuing with my previous notes I shared with you that was the Properties of Fourier transform. Now you have to solve these numericals based on these properties.

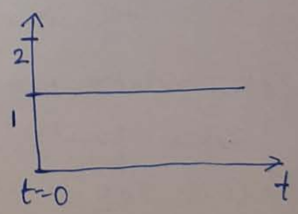
Problem ① Based on Linearity property

Q→. find the fourier transform of a given signal

$$x(t) = 2 \quad , t = 0$$
$$= 1 \quad , t > 0.$$

The signal is shown as

Here at $t=0$ the function value is 2 at at $t>0$ its value is 1 that is the unit step function.



Important → Here you have to study first the unit step function and its fourier transform and other properties then you will be able to solve this problem.

② Q → Find the fourier transform of $x(t) = e^{-at} x(t) + u(t) + \delta(t)$

· Here $\delta(t)$ is an impulse function.

Important → You have to Study the fourier transform of an ~~delta~~ impulse function and its properties to solve this problem.

Problem II → Based on Shifting property or translation Property.

1. Q → Find the fourier transform of $u(t-1)$.

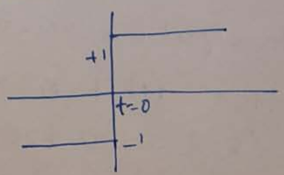
Problem III → Based on Time Scaling property

1. Q → Find the fourier transform of $\delta(2t)$

2. Q → Find the fourier transform of Sgn $(2t)$.
Here Sgn is Called Signam function and is defined as

$$\text{Sgn} = \begin{cases} -1 & t<0 \\ 0 & t=0 \\ 1 & t>0 \end{cases}$$

the Signam function is represented as



the relation between Signam function and unit Step function is given by

$$\text{Sgn} = 2u(t) - 1.$$

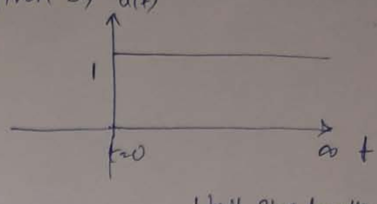
Problem IV → Based on fourier transform of derivative.

① Q → Find the fourier transform of Sgn function. when the sgn function is defined above.

Unit Step function →

Unit Step signal is given by

$u(t) = \begin{cases} 1 & t \geq 0 \\ 0 & t < 0 \end{cases}$



Unit Step function

Q → Find the fourier transform of $u(t)$ i.e., unit Step function.

Important →

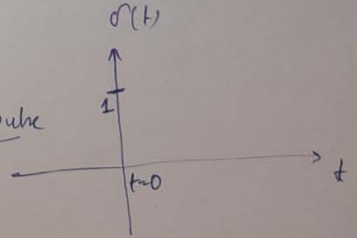
① If we multiply any function by $u(t)$ then its limit exists only for 0 to ∞. Because unit step function is defined in the limit $0 \rightarrow \infty$.

② If we differentiate unit step function then we get the impulse function represented as $\delta(t)$.

Impulse function →

Unit Impulse function is given by $\delta(t)$

$\delta(t) = \begin{cases} 1 & t = 0 \\ 0 & t \neq 0 \end{cases}$



Q → Find the fourier transform unit impulse function ~~of~~ $\delta(t)$.

Important → $\int_{-\infty}^{\infty} \delta(t)\, dt = 1$

It means that if you have a unit impulse function then area covered by unit impulse is one. And if it is simply an impulse function then the area may varies.