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-: Convolution Theorem :-

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① * State Convolution Theorem and Apply it to Evaluate: $L^{-1}\left[\frac{1}{(s^2+a^2)^2}\right]$

② * Using Convolution Theorem Evaluate;

$$L^{-1}\left[\frac{s^2}{(s^2+a^2)^2}\right]$$

③ * Using Convolution Theorem Evaluate,

$$L^{-1}\left[\frac{s}{(s^2+a^2)^2}\right]$$

④ * Using Convolution Theorem Solve.

$$L^{-1}\left[\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right]$$

(Same as Example- 2)

⑤ * Using Convolution Theorem solve,

$$L^{-1}\left[\frac{1}{s(s+3)}\right]$$

⑥ Solve the convolution Theorem and verify it for $f(t) = t$ & $g(t) = e^{2t}$

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:- Power series :-

1) find power series solⁿ of the equation

$$(1+x^2)\, y'' + xy' - 9y = 0$$ in power of x.

2) find the series solⁿ of

$$(1+x^2)\, y'' + xy' - xy = 0$$

3). Solve in series the equation

$$\frac{d^2y}{dx^2} + x^2 y = 0$$

↳ similary, $\frac{d^2y}{dx^2} + xy = 0$

4) Determine the series solution for the differential eqⁿ

$y'' + y = 0$ about $x_0 = 0$.

5). Find the series solⁿ of

$$(1-x^2)\, y'' - 2xy' + 2y = 0.$$

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Partial Diff. eqⁿs

Method of separation of Variables :-

* Solve $2\frac{\partial u}{\partial x} = \frac{\partial u}{\partial t} + u$ subjected to the condition $u(x,0) = 4e^{-3x}$.

* Solve $x\frac{\partial u}{\partial x} - 2y\frac{\partial u}{\partial y} = 0$ using method of separation of variables.

* Solve $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$ by the method of seperation of variables.

* Using seperable variable technique find the acceptable general solⁿ to the one dimension heat eqⁿ $\frac{\partial u}{\partial t} = c^2\frac{\partial^2 u}{\partial x^2}$ and find the solⁿ satisfying the conditions $u(0,t) = u(\pi,t) = 0$ for $t>0$ and $(u(x,0)) = \pi - x$, $0<x<\pi$.

fourier integral.

1). Using fourier int. representation prove that

$$\int_0^\infty \frac{\cos\omega x + \omega\sin\omega x}{1+\omega^2}\, d\omega = \begin{cases} 0 & \text{if } x<0 \\ \pi/2 & x=0 \\ \pi e^{-x} & x>0 \end{cases}$$

2). find fourier integral representation of the function

$$f(x) = \begin{cases} 1 & \text{if } |x| < 1 \\ 0 & \text{if } |x| > 1 \end{cases}$$

similar.

$$f(x) = \begin{cases} 2 & |x|<2 \\ 0 & |x|>2 \end{cases}$$

same of

3). find fourier cosine integral of $f(x) = e^{-kx}$ where $x>0$ & $k>0$.

(Que=1 same ω ની જગ્યાએ λ કરીને પુછાયા છે.)

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÷ Definations:-

(4 Marks):

1) Gamma Function
2) Beta Function
3) Bessel Function
4) Error Function
5) Unit step Function
6) Dirac's Delta Function
7) Relationship Between beta and gamma Function

$$\beta(m,n) = \frac{\Gamma m \, \Gamma n}{\Gamma m+n}$$

8). Sinusoidal Pulse Function.
9) Square wave Function

First Order Diff. eq^n.

Imp Topic.

1). Linear Diff. eq^n.
2) Variable separable & Homogenius
3). Exact Diff. eq^n.
4). Non Exact Diff. eq^n
5) Orthogonal trajectories

fourier series.

* $(-\pi < x < \pi)$

$f(x) = |x|$
$f(x) = x + |x|$
$f(x) = |\sin x|$
$f(x) = x \sin x$

* Halfrange sine series :-
Halfrange cosine series :-

→ obtain halfrange cosine series for $f(x) = \sin x$ where $0 < x < \pi$.

→ obtain halfrange sine series for $f(x) = \cos x$ where $0 < x < \pi$.

⇒ obtain halfrange cosine series for $f(x) = x^2$
$0 < x < \pi$

⇒ obtain fourier sine series for $f(x) = 2x$
$0 < x < 1$.

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: Interval :-

* obtain a fourier series for

$$f(x) = \begin{cases} \pi + x & 0 < x < \pi \\ \pi - x & \pi < x < 2\pi \end{cases}$$

* obtain a fourier series expansion for

$$f(x) = \begin{cases} 1 + \frac{2x}{\pi} & -\pi < x < 0 \\ 1 - \frac{2x}{\pi} & 0 < x < \pi \end{cases}$$

* obtain a fourier series for

$$f(x) = \begin{cases} \pi x & 0 \le x \le 1 \\ \pi(2-x) & 1 \le x \le 2 \end{cases}$$

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: fourier series:-

$0 < x < 2\pi$ $\quad f(x) = e^{ax}$

or

$-\pi < x < \pi$ $\quad = e^{2x}, \; e^{-x}, \; e^{3x}$

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fourier series in interval $(-l, l)$, $(0, l)$

ex. $(-1, 1)$, $(-2, 2)$, $(-3, 3)$, $(0, 2)$, $(0, 4)$, $(0, 6)$, etc.

* $f(x) = 1 - x^2$. $\quad -1 < x < 1$

$f(x) = x^2$ $\quad -2 < x < 2$

$f(x) = 2x - x^2$ $\quad 0 < x < 3$