Imp Question Bank.

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UNIT - I.

(1) Solve :
$$(1+x)^2 \frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 2\sin\log(1+x)$$

(2) $(D^3+1)y = \sin 3x - \cos^2 \frac{x}{2}$.

(3) $(D^2+5D+6)y = e^{-2x}\sin 2x + 4x^2 e^x$

(4) Solve by VOP.
$$\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = \cos e^x.$$

(5) $(2x+1)^2 \frac{d^2y}{dx^2} - 2(2x+1)\frac{dy}{dx} - 12y = 6x$

(6) $(D^4 - m^4)y = \sin mx$

(7) $x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} + 4y = \cos(\log x) + x\sin(\log x)$

(8) $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$ by VOP.

(9) Solve $(D^2+2D+2)y = \sinh x + x^2$

(10) Solve $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 5y = x^2\log x$

UNIT - II

(1) using convolution thm, find $L^{-1}\left[\frac{(s+2)^2}{(s^2+4s+8)^2}\right]$

(2) find $f(t)$ if $\bar{F}(s) = \log\left(\frac{s+b}{s+a}\right)$

(3) Find Laplace transform of the periodic fun,

$$f(t) = \frac{t}{a}, \quad 0 < t < a$$

$$= \frac{1}{a}(2a-t), \quad a < t < 2a$$

and $f(t) = f(t+2a)$

(4) Find $L^{-1}\left[\frac{s}{(s+1)(s+9)^2}\right]$

(5) Find $L\left[\frac{d}{dt}\left(\frac{\sin t}{t}\right)\right]$

(6) evaluate $\int_0^\infty \frac{\cos 6t - \cos 4t}{t}\, dt$

(7) Find $f(t)$ if $\bar{F}(s) = \frac{1}{2}\log\frac{(s-1)}{(s+1)}$.

(8) using Convolution thm find $L^{-1}\left[\frac{1}{(s+1)(s^2+1)}\right]$

(9) Find L.T of $f(t)$ if, $f(t) = a\sin pt, \quad 0 < t < \pi/p$

$$= 0, \quad \frac{\pi}{p} < t < \frac{2\pi}{p}$$

and $f(t) = f\left(t + \frac{2\pi}{p}\right)$

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UNIT - III

(1) Solve by using laplace transform $\frac{d^2x}{dt^2} + x = 6\cos 2t$ with $x=3$, $\frac{dx}{dt} = 1$ at $t=0$.

(2) using fourier cosine integral S.T. $\int_0^\infty \frac{\cos\omega x}{k^2+\omega^2}\, d\omega = \frac{\pi e^{-kx}}{2k}$, $x>0, k>$

(3) solve by using laplace transform $(D^2+2D+5)y = e^{-t}\cdot \sin t$, whr, $y(0)=0$ and $y'(0)=1$.

(4) Find fourier sine transform of $e^{-|x|}$ and evaluate $\int_0^\infty \frac{x\sin mx}{1+x^2}\,dx$

(5) using fourier integral representation, S.T. $\int_0^\infty \frac{\omega \sin x\omega}{1+\omega^2}\, d\omega = \frac{\pi}{2} e^{-x}$, $(x>0)$

(6) Express the function $f(x) = 1, \ |x| \leq 1$
$= 0, \ |x| \geq 1$
as Fourier integral. Hence evaluate $\int_0^\infty \frac{\sin\lambda \cos\lambda x}{\lambda}\, d\lambda$.

(7) Find fourier sine transform of $f(x) = \frac{e^{-ax}}{x}$

UNIT - VI

(1) Find the D.D. of surface $\phi = x^2y + y^2z + z^2x$ at point $(3,1,2)$ in the direction of Normal to the surface $xyz = 6$ at the point $(1,2,3)$.

(2) A fluid motion is given by
$\bar{V} = (y \sin z - \sin x)i + (x \sin z + 2yz)j + (xy \cos z + y^2)K$
Is the motion is irrotational? If so, find scalar potential function.

(3) Evaluate $\iint_S \bar{F} \cdot \hat{n} \, ds$, w.r.
$\bar{F} = yzi + zxj + xyk$ and s is the surface of the plane $x^2 + y^2 + z^2 = 1$ in the 1st octant

(4) Find the angle betn the normal to the surface $x \log z - y^2 = -4$ and $x^2y + z = 3$ at pt $(-1, 2, 1)$.

(5) Find the directional derivative of $f(x,y,z) = x^2y^2z^2$ at pt $(1,1,-1)$ in the direction of tangent to the curve $x = e^t$, $y = 2\sin t$, $z = t - \cos t$ at $t = 0$.

(6) A vector field is given by
$\bar{F} = (x^2 - y^2 + x)i - (2xy + y)j$ S.T
the field is irrotational and find scalar potential.

(7) If $\bar{F} = (2x^2 - 3z)i - 2xy\,j - 4xk$
then evaluate: $\iiint_V \nabla \cdot \bar{F}\, dv$, where

v is bounded by $x = 0$, $y = 0$, $z = 0$
and $2x + 2y + z = 4$.

UNIT - V

1. Find the analytic function whose real part is $u = e^{2x}(x\cos 2y - y\sin 2y)$.

2. Find 'p' such that function $f(z) = \frac{1}{2}\log(x^2+y^2) + i\tan^{-1}\left(\frac{px}{y}\right)$ is analytic.

3. S.T the transformation $\omega = z^2$ maps the circle $|z-1| = 1$ into the cardiode $\rho = 2(1+\cos\phi)$ where $\omega = \rho e^{i\phi}$.

4. If $f(z)$ is regular analytic function of z. P.T
$$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$$

5. Expand $f(z) = \sin z$ in Taylor Series at $z = \frac{\pi}{6}$.

6. S.T under transformation $\omega = \frac{2z+3}{z-4}$ the circle $|z-2| = 2$ in z plane is transform into straight line $4u + 3 = 0$ in ω-plane.

(7) Expand the function $\frac{1}{(z+1)(z+2)}$

in the region

i) $0<|z|<1$, (ii) $1<|z|<2$

(iii) $|z|>2$

(8) Expand $\frac{1}{z^2-4z+3}$ in the region.

i) $|z|<1$,

ii) $1<|z|<3$

iii) $|z|>3$

iv) $0<|z-1|<2$.

UNIT – IV

(1) Solve: P.D.E.

(1) $p \tan x + q \tan y = \tan z$

(2) $\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = \frac{3a^2}{z^2}$

(3) $(mz - ny)p + (nx - lz)q = ly - mx$

(4) $\sqrt{p} + \sqrt{q} = 2x$

(5) $yp + xq + pq = 0.$

(5) If a cap R related with v by relation $R = a + bv + cv^2$, find, a, b, c for corresponding data.

V	20	40	60	80	100	120
R	5.5	9.1	14.9	22.8	33.3	46.0

(6) Obtain eqn of line of regression y on x.

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

(7) Find the coefficient of correlation.

x	10	14	18	22	26	30
y	18	12	24	6	30	36