



- i) The Fourier sine transform of  $f(x) = \begin{cases} k, & 0 < x < a \\ 0, & x > a \end{cases}$  is  
 (A)  $\sqrt{\frac{2}{\pi}}k \left( \frac{\sin a\lambda}{\lambda} \right)$  (B)  $\sqrt{\frac{2}{\pi}}k \left( \frac{1 - \cos a\lambda}{\lambda} \right)$  (C)  $\sqrt{\frac{2}{\pi}}k \left( \frac{\sin a\lambda}{a} \right)$   
 (D) none of these
- j) The finite Fourier cosine transform of  $f(x) = 2x, 0 < x < 4$  is  
 (A)  $\frac{32}{n^2\pi^2} [(-1)^n - 1]$  (B)  $\frac{16}{n^2\pi^2} [(-1)^n - 1]$  (C)  $\frac{32}{n^2\pi^2} (-1)^n$  (D) none of these
- k) Which one of the following is an analytic function  
 (A)  $f(z) = \operatorname{Re} z$  (B)  $f(z) = \operatorname{Im} z$  (C)  $f(z) = \bar{z}$  (D)  $f(z) = \sin z$
- l) The image of circle  $|z - 1| = 1$  in the complex plane, under the mapping  $w = \frac{1}{z}$  is  
 (A)  $|w - 1| = 1$  (B)  $u^2 + v^2 = 1$  (C)  $v = \frac{1}{z}$  (D)  $u = \frac{1}{z}$
- m) The magnitude of acceleration vector at  $t = 0$  on the curve  
 $x = 2 \cos 3t, y = 2 \sin 3t, z = 3t$  is  
 (A) 6 (B) 9 (C) 18 (D) 3
- n) If  $\phi = xyz$ , the value of  $|\operatorname{grad} \phi|$  at the point  $(1, 2, -1)$  is  
 (A) 0 (B) 1 (C) 2 (D) 3

**Attempt any four questions from Q-2 to Q-8**

**Q-2**

**Attempt all questions**

**(14)**

- a) Given

**(5)**

x:	10	20	30	40	50
y:	600	512	439	346	243

Using Stirling's formula find  $y_{35}$ .

- b) Given that

**(5)**

x	1.00	1.05	1.10	1.15	1.20	1.25	1.30
y	1.00000	1.02470	1.04881	1.07238	1.09544	1.11803	1.14017

Find  $\frac{d^2y}{dx^2}$  at  $x = 1.05$ .

- c) Find the finite Fourier cosine transform of  $f(x) = 2x, 0 < x < 4$ .

**(4)**

**Q-3**

**Attempt all questions**

**(14)**

- a) Solve the following system of equations by Gauss-Seidal method.

**(5)**

$$10x_1 + x_2 + 2x_3 = 44, \quad 2x_1 + 10x_2 + x_3 = 51, \quad x_1 + 2x_2 + 10x_3 = 61$$

- b) Using Newton's forward interpolation formula, find the value of  $y(2.35)$  if

**(5)**

x	2.00	2.25	2.50	2.75	3.00
f(x)	9.00	10.06	11.25	12.56	14.00

- c) If  $f(z) = u + iv$  is an analytic function of  $z$  and  $u + v = e^x (\cos y + \sin y)$ , find  $f(z)$ .

**(4)**



**Q-4 Attempt all questions (14)**

- a) Use the fourth – order Runge Kutta method to solve  $\frac{dy}{dx} = x^2 + y^2$ ;  $y(0) = 1$  . (5)

Evaluate the value of  $y$  when  $x = 0.1$ .

- b) Evaluate  $\int_0^6 \frac{dx}{1+x^2}$  by using Simpson’s 3/8<sup>th</sup> rule. (5)

- c) Solve the following system of equations by Gauss Elimination Method: (4)  
 $5x - 2y + 3z = 18$ ,  $x + 7y - 3z = -22$ ,  $2x - y + 6z = 22$

**Q-5 Attempt all questions (14)**

- a) Show that the function defined by the equation (5)

$$f(z) = \begin{cases} u(x, y) + iv(x, y), & \text{if } z \neq 0 \\ 0 & , \text{ if } z = 0 \end{cases}$$

where  $u(x, y) = \frac{x^3 - y^3}{x^2 + y^2}$  and  $v(x, y) = \frac{x^3 + y^3}{x^2 + y^2}$  is not analytic at  $z = 0$  although

Cauchy – Riemann equations are satisfied at that point.

- b) If  $\vec{F} = (2x^2 - 4z)i - 2xyj - 8x^2k$ , then evaluate  $\iiint_V \text{div } \vec{F} \, dV$ , where  $V$  is (5)

bounded by the planes  $x = 0$ ,  $y = 0$ ,  $z = 0$ ,  $x + y + z = 1$ .

- c) Given that table of values as (4)

$x$	20	25	30	35
$y$	0.342	0.423	0.500	0.650

Find  $x(0.390)$  using Lagrange’s inverse interpolation formula.

**Q-6 Attempt all questions (14)**

- a) Prove that  $\vec{F} = (y \cos z - \sin x)i + (x \sin z + 2yz)j + (xy \cos z + y^2)k$  is (5)

irrotational and find its scalar potential.

- b) Find the bilinear transformation which sends the points  $z = 0, 1, \infty$  into the points (5)  
 $w = -5, -1, 3$  respectively. What are the invariant points of the transformation?

- c) Obtain Picard’s second approximation solution of the initial value problem (4)

$\frac{dy}{dx} = x^2 + y^2$  for  $x = 0.4$  correct to four decimal places, given that  $y(0) = 0$ .

**Q-7 Attempt all questions (14)**

- a) Using Cauchy – Riemann equations, prove that if  $f(z) = u + iv$  is analytic with (5)  
constant modulus, then  $u, v$  are constants.

- b) Using Green’s Theorem, evaluate  $\oint_C [(y - \sin x)dx + \cos x dy]$  where  $C$  is the (5)

plane triangle enclosed by the lines  $y = 0$ ,  $x = \frac{\pi}{2}$  and  $y = \frac{2}{\pi}x$ .

- c) The function  $f(x)$  is given as follows: (4)

$x$	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
$y$	1	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0

Compute the integral of  $f(x)$  between  $x = 0$  and  $x = 1.0$  using Trapezoidal rule.



**Q-8**

**Attempt all questions**

**(14)**

- a) Use Euler's method to find an approximate value of  $y$  at  $x = 0.1$ , in five steps, (5)  
given that  $\frac{dy}{dx} = x - y^2$  and  $y(0) = 1$ .
- b) Find the Fourier sine transform of  $f(x) = \begin{cases} 0 & 0 < x < a \\ x & a \leq x \leq b \\ 0 & x > b \end{cases}$ . (5)
- c) Find the angle between the tangents to the curve  $x = t^2 + 1, y = 4t - 3, z = 2t^2 - 6t$  (4)  
at the points  $t = 1$  and  $t = 2$ .

