



Q-3

**Attempt all questions**

- a) Determine analytic function whose imaginary part is  $e^x (x \cos y - y \sin y)$  (05)
- b) If  $f(z) = u + iv$  is an analytic function of  $z$  and  $u + v = e^x (\cos y + \sin y)$ , find  $f(z)$ . (05)
- c) Find  $p$  such that the function  $f(z) = r^2 \cos 2\theta + i r^2 \sin p\theta$  is analytic. (04)

Q-4

**Attempt all questions**

- a) Under the transformation  $w = \frac{1}{z}$  (05)
- i. Find the image of  $|z - 2i| = 2$ .
- ii. Show that the image of the hyperbola  $x^2 - y^2 = 1$  is the lemniscate  $\rho^2 = \cos 2\theta$
- b) Find the bilinear transformation which sends the points  $z = 0, 1, \infty$  in to the points  $w = -5, -1, 3$  respectively. What are the invariant points of the transformation? (05)

- c) Following table gives the values of  $x$  and  $y$ : (04)

$x$	1.0	1.05	1.10	1.15	1.20	1.25	1.30
$y$	1.00	1.02470	1.04881	1.07238	1.09544	1.11803	1.14017

Find  $\frac{dy}{dx}$  for  $x = 1.05$  using forward difference.

Q-5

**Attempt all questions**

- a) Solve by Gauss – Jordan method (05)
- $$5x - 2y + 3z = 18, \quad x + 7y - 3z = -22, \quad 2x - y + 6z = 22.$$
- b) Solve the equation (05)
- $$27x + 6y - z = 85, \quad 6x + 5y + 2z = 72, \quad x + y + 54z = 110$$
- by Gauss – Seidel method.
- c) If  $\vec{F} = (x + y + 1)i + j - (x + y)k$  find  $\vec{F} \cdot \text{curl } \vec{F}$ . (04)

Q-6

**Attempt all questions**

- a) Verify Green's theorem for the function  $\vec{F} = (x + y)i + 2xyj$  and  $C$  is the rectangle in  $XY$  – plane bounded by  $x = 0, y = 0, x = a, y = b$ . (07)
- b) Verify Stokes's theorem for  $\vec{A} = (2x - y)i - yz^2j - y^2zk$ , where  $S$  is the upper half surface of sphere  $x^2 + y^2 + z^2 = 1$  and  $C$  is its boundary. (07)

Q-7

**Attempt all questions**

- a) Use the fourth – order RungeKutta method to solve  $\frac{dy}{dx} = y - \frac{2x}{y}, y(0) = 1$ . (05)
- Evaluate the value of  $y$  when  $x = 0.1$
- b) Find the value of  $y$  for  $x = 0.1$  by Picard's method, given that (05)



$$\frac{dy}{dx} = \frac{y - x}{y + x}, y(0) = 1$$

- c) Following table gives the values of  $x$  and  $y$ : (04)

$x$	30	35	40	45	50
$y$	15.9	14.9	14.1	13.3	12.5

Find value of  $x$  corresponding to  $y = 13.6$

**Attempt all questions** (14)

- a) Construct Newton's forward interpolation polynomial for the following data: (05)

X	4	6	8	10
Y	1	3	8	16

Use it to find the value of  $y$  for  $x = 5$ .

- b) Use Lagrange's interpolation formula to find the value of  $y$  when  $x = 10$ , if the values of  $x$  and  $y$  are given below: (05)

$x$	5	6	9	11
$y$	12	13	14	16

- c) Divide the range into 10 equal parts, find the approximate value of  $\int_0^{\pi} \sin x \, dx$  by Simpson's  $\frac{1}{3}$  rule. (04)

Q-8

