



- g)  $E^{-1}$  equal to  
 (A)  $1-\nabla$  (B)  $1+\nabla$  (C)  $1+\delta$  (D)  $1-\delta$
- h)  $hD$  equal to  
 (A)  $\log(1+\Delta)$  (B)  $\log(1-\Delta)$  (C)  $\log(1+E)$  (D)  $\log(1-E)$
- i) The  $n$ th difference of a polynomial of degree  $n$  is  
 (A) constant (B) zero (C)  $n!$  (D) none of these
- j) In application of Simpson's  $\frac{1}{3}$  rule, the interval of integration for closer approximation should be  
 (A) odd and small (B) even and small (C) even and large  
 (D) none of these
- k) The convergence in the Gauss – Seidel method is faster than Gauss – Jacobi method.  
 (A) TRUE (B) FALSE
- l) The Gauss – Jordan method in which the set of equations are transformed into diagonal matrix form.  
 (A) TRUE (B) FALSE
- m) Using modified Euler's method, the value of  $y(0.1)$  for  
 $\frac{dy}{dx} = x - y, y(0) = 1$  is  
 (A) 0.909 (B) 0.809 (C) 0.0809 (D) 0.0908
- n) Which of the following methods is the best for solving initial value problems:  
 (A) Taylor's series method (B) Euler's method  
 (C) Runge-Kutta method of 4<sup>th</sup> order (D) Modified Euler's method

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

**Q-2 Attempt all questions (14)**

- a) Use Stirling's formula to find  $y_{28}$  given that (5)  
 $y_{20} = 49225, y_{25} = 48316, y_{30} = 47236, y_{35} = 45926$  and  $y_{40} = 44306$ .
- b) Construct Newton's forward interpolation polynomial to the following (5)  
 data:

$x$	4	6	8	10
$y$	1	3	8	16

- c) Find the Fourier sine transform of  $f(x) = \begin{cases} 0 & 0 < x < a \\ x & a \leq x \leq b \\ 0 & x > b \end{cases}$  (4)

**Q-3 Attempt all questions (14)**

- a) Solve the following system of equations by Gauss-Seidal method. (5)  
 $10x_1 + x_2 + 2x_3 = 44, 2x_1 + 10x_2 + x_3 = 51, x_1 + 2x_2 + 10x_3 = 61$
- b) The population of a certain town is shown in the following table: (5)

Year	1961	1971	1981	1991	2001
Population (in thousands)	19.96	36.65	58.81	77.21	94.61



Find the rate of growth of population in 1991.

- c) Show that  $u(x, y) = 2x - x^3 + 3xy^2$  is harmonic in some domain and find a harmonic conjugate of  $u(x, y)$ . (4)

**Q-4**

**Attempt all questions**

(14)

- a) Use Euler's method to find an approximate value of  $y$  at  $x = 0.1$ , in five steps, given that  $\frac{dy}{dx} = x - y^2$  and  $y(0) = 1$ . (5)

- b) Evaluate  $\int_0^{0.6} e^{-x^2} dx$  by using Simpson's 1/3<sup>rd</sup> rule. (5)

- c) Solve the following system of equations using Gauss-elimination method: (4)

$$-x_1 + x_2 + 2x_3 = 2, \quad 3x_1 - x_2 + x_3 = 6, \quad -x_1 + 3x_2 + 4x_3 = 4$$

**Q-5**

**Attempt all questions**

(14)

- a) Show that the function  $f(z) = \sqrt{|xy|}$  is not analytic at the origin, although Cauchy-Riemann equations are satisfied. (5)

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

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

- c) Compute  $f(9.2)$  by using Lagrange Interpolation formula from the following data: (4)

$x$	9	9.5	11
$y$	2.1972	2.2513	2.3979

**Q-6**

**Attempt all questions**

(14)

- a) Prove that  $\vec{F} = (y^2 \cos x + z^3)\hat{i} + (2y \sin x - 4)\hat{j} + 3xz^2\hat{k}$  is irrotational and find its scalar potential. (5)

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

- c) Solve  $\frac{dy}{dx} = 3 + 2xy$  where  $y(0) = 1$  for  $x = 0.1$  by Picard's method. (4)

**Q-7**

**Attempt all questions**

(14)

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

- b) If  $\vec{F} = (2xy + z^3)\hat{i} + x^2\hat{j} + 3xz^3\hat{k}$ , show that  $\int_C \vec{F} \cdot d\vec{r}$  is independent of the (5)

path of integration. Hence evaluate the integral when  $C$  is any path joining  $A(1, -2, 1)$  to  $B(3, 1, 4)$ .

- 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) Using Taylor's series method, compute  $y(-0.1)$ ,  $y(0.1)$ ,  $y(0.2)$  correct to four decimal places, given that  $\frac{dy}{dx} = y - \frac{2x}{y}$ ,  $y(0) = 1$  **(5)**
- b) Find the Fourier cosine and sine integral of  $f(x) = e^{-kx}$  ( $x > 0$ ,  $k > 0$ ). **(5)**
- c) Find the angle between the tangents to the curve  $x = t^2$ ,  $y = 2t$ ,  $z = -t^3$  at the points  $t = 1$  and  $t = -1$ . **(4)**

