

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- IV (Old) EXAMINATION – WINTER 2019

Subject Code: 140001

Date: 07/12/2019

Subject Name: Mathematics-IV

Time: 10:30 AM TO 01:30 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Find the fifth root of unity. 07

(b) Define interpolation. Using Lagrange's interpolation, find $y(2)$. 07

x	-1	0	1	3
y	2	1	0	-1

Q.2 (a) Define bilinear transformation. Find bilinear transformation which maps points 0, 1, ∞ into points $-1, -i, 1$ respectively. 07(b) Expand $\frac{1}{z^2-3z+2}$ in Laurent series in region (i) $1 < |z| < 2$ (ii) $|z| > 2$. 07

OR

(b) Prove that $\tan h^{-1}z = \frac{1}{2} \log \left(\frac{1+z}{1-z} \right)$ 07Q.3 (a) State Cauchy's integral formula. Evaluate $\oint_C \frac{3z^2+z}{z^2-1} dz$; where $|z-1|=1$. 07

(b) Define (i) Analytic function (ii) Harmonic function. 07

If $f(z) = u(x, y) + iv(x, y)$ is analytic and $u(x, y) = y^3 - 3x^2y$, then find $v(x, y)$.

OR

Q.3 (a) Derive Cauchy – Riemann equations in polar form. 07

(b) Evaluate $\oint_C \pi \exp(\pi \bar{z}) dz$; where C is the boundary of square with vertices 0, 1, $1+i, i$ with counterclockwise direction. 07Q.4 (a) Prove that (i) $(1 + \Delta)(1 - \nabla) = 1$ (ii) $E = e^{hD}$ 07(b) Using Runge-Kutta 4th order method find $y(0.1)$. 07

$$\frac{dy}{dx} = x^2 + y^2 ; \quad y(0) = 1$$

OR

Q.4 (a) Find Newton's forward interpolating polynomial and hence find $y(5)$. 07

x	4	6	8	10
y	1	3	8	16

(b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ (take $h=1$) using 07

(i) Trapezoidal rule (ii) Simpson's 1/3 rule and (iii) Simpson's 3/8 rule.

Q.5 (a) Set up Newton iteration for computing square root of given positive number N and find $\sqrt{2}$. 07

(b) Evaluate using 2 point and 3 point Gaussian integration. 07

$$\int_0^1 \frac{dx}{1+x}$$

- Q.5 (a) Find a root of $x^3 - 4x - 9 = 0$ correct upto three decimal places using Bisection method. **07**
- (b) Solve by Gauss-Siedel method correct upto 3 decimal places. **07**
- $$\begin{aligned} 27x + 6y - z &= 85 \\ 6x + 15y + 2z &= 72 \\ x + y + 54z &= 110 \end{aligned}$$

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