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VELAGAPUDI RAMAKRISHNA

SIDDHARTHA ENGINEERING COLLEGE

(AUTONOMOUS)

II/IV B.Tech. DEGREE EXAMINATION, March, 2022

Third Semester

20BS3101B COMPLEX ANALYSIS & NUMERICAL METHODS

(ECE / EIE / IT)

Time: 3 hours ***Max. Marks: 70***

Part-A is compulsory

Answer One Question from each Unit of Part - B

Answer to any single question or its part shall be written at one place only

PART-A

10 x 1 = 10M

1. a. Write the Cauchy-Riemann Equations in Polar form.

   b. Define Analytic function.

   c. State Cauchy's integral formula.

   d. Determine the residue of $f(z) = \frac{z+1}{z(z-2)}$ at z=2.

   e. Define critical point.

   f. Find the fixed point of the function $w = \frac{z-1}{z+1}$.

   g. Define algebraic equation with an example.

   h. What is the relation between Δ and E?

   i. Write Newton's backward interpolation formula.

   j. State Trapezoidal rule.

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PART-B

4 x 15 = 60M

UNIT-I

2. a. Prove that $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$, where $f(z)$ is an analytic function. **8M**

   b. Show that the function $u = e^{-2xy}\sin(x^2 - y^2)$ is harmonic. Find the conjugate function v and express $u + iv$ as an analytic function of Z. **7M**

(or)

3. a. State and prove Cauchy's Integral theorem. **7M**

   b. Evaluate contour integral $\int_c \frac{z}{z^2-3z+2}dz$ where $C: |z-2| = \frac{1}{2}$ using Cauchy's integral formula. **8M**

UNIT-II

4. a. Find a Taylor's series for $f(z) = \frac{1}{(z+1)^2}$ about the point z = -i. **7M**

   b. Evaluate $\oint_c \frac{z}{(z-1)(z-2)^2}dz$ where $c: |z-2| = \frac{1}{2}$ by applying theory of residues. **8M**

(or)

5. a. Evaluate by using contour integration $\int_0^{2\pi} \frac{\cos 3\theta}{5-4\cos\theta} d\theta$. **7M**

b. Construct the bilinear the transformation which maps the points $(-1, i, 1)$ of the z-plane onto $(1, i, -1)$ of the w-plane respectively. **8M**

UNIT-III

6. a. Apply Newton–Raphson method to find a positive root of the equation $\cos x - xe^x = 0$. **8M**

b. Solve the following system of equations by using Gauss–Seidel iterative method
$5x + 2y + z = 12, x + 4y + 2z = 15, x + 2y + 5z = 20$. **7M**

(or)

7. a. Using Newton's backward interpolation formula, estimate the value of $f(4)$ from the following data **8M**

x	0	1	2	3
$f(x)$	1	2	1	10

b. Apply Lagrange's interpolation formula, compute the value of $f(9)$ from the following data **7M**

x	5	7	11	13	17
$f(x)$	150	392	1492	2366	5202

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UNIT-IV

8. a. Find first and second derivatives of the function tabulated below at the point $x = 1.6$ **7M**

x	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y	7.989	8.403	8.781	9.129	9.451	9.750	10.031

b. Find the values of $y(0.1)$ and $y(0.2)$ given that $y' = 2y + 3e^x$, $y(0) = 0$ by using Taylor's series method. **8M**

(or)

9. a. Evaluate $\int_0^6 \frac{1}{1+x^2} dx$ by using Simpson's 1/3 rule. **7M**

b. Apply fourth order Runge-Kutta method to evaluate $y(0.1)$ and $y(0.2)$ given that $y' = x^2 - y$ and $y(0) = 1$. **8M**

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