

A

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code: R2M03

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Second Semester

Computer Science and Engineering

R21UMA203- DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS

(Common to IT, CSE (SC) and CSE (IoT) Engineering Branches)

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- Particular Integral of $(D^2 + 3D + 2)y = 16$ CO1- App
(a) 3 (b) 4 (c) 0 (d) 8
- Complementary function of $(D - 1)^3 y = 2x$ CO1- App
(a) $(A + Bx + cx^2)e^x$ (b) $(A + Bx + cx^2)e^{-x}$ (c) $(A + Bx + cx^2)$ (d) $(Ax + Bx^2 + cx^3)e^x$
- Divergence of vector $x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$ at (1, 2, -3) is _____ CO2- App
(a) 8 (b) 4 (c) -3 (d) 0
- If $\vec{F}$ is irrotational then CO6- U
(a) $\nabla \times \vec{F} = 0$ (b) $\nabla \times \vec{F} = \vec{0}$ (c) $\nabla \cdot \vec{F} = \vec{0}$ (d) $\nabla \cdot \vec{F} = 0$
- The critical point of the transformation $w = 2z + \frac{1}{z}$ are _____ CO3- App
(a) ± 1 (b) ± 2 (c) $\pm i$ (d) $-i$
- The function $f(z) = \frac{1}{z^2 + 4}$ is not analytic at $z =$ _____ CO3- App
(a) 2 (b) -2 (c) 2i (d) $\pm 2i$
- Simple pole is a pole of order _____ CO6- U
(a) 1 (b) 4 (c) 3 (d) 4

8. The value of $\int_C \frac{dz}{z+2}$, $C: |z| = 1$ is _____ CO4- App
 (a) $2\pi i$ (b) 0 (c) $4\pi i$ (d) 0
9. The PDE obtained from $z = (x+a)(y+b)$ is _____. CO5- App
 (a) $3z = px + qy$ (b) $py - qx = 0$ (c) $z = pq$ (d) $px+qy = 0$
10. One dimensional wave equation is _____. CO6- U
 (a) parabolic (b) hyperbolic (c) elliptic (d) cyclic

PART – B (5 x 2= 10 Marks)

11. Compute the particular integral for $(D^2-2D+1)y=\cosh x$ CO1-App
12. Compute if $\phi = x^2 + y^2 + z^2$ at (1, -1, 1). CO2-App
13. Show that the function $f(z) = \bar{z}$ is nowhere differentiable. CO3-App
14. Using Cauchy's integral formula, evaluate CO4-App

$$\int_C \frac{z}{z-2} dz \text{ where } C \text{ is } |z| = 1$$

15. Form the partial differential equation by eliminating the arbitrary constants a and b from $z=ax+by+ab$. CO5-App

PART – C (5 x 16= 80 Marks)

16. (a) (i) Solve the differential equation $(D^2 + 5D + 4)y = e^{2x} + x^2$ CO1- App (8)
 (ii) Using method of variation of parameter solve $D^2 + a^2)y = \cot ax$. CO1- App (8)
- Or
- (b) (i) Solve the differential equation CO1- App (8)
 $[(x+1)^2 D^2 + (x+1)D + 4]y = \cos[\log(x+1)]$
 (ii) If the population of a country double in 50 years, in how many years will it triple under the assumption that the rate of increase of proportional to the number of inhabitants? CO1- App (8)
17. (a) (i) Prove that $\vec{F} = (6xy + z^3)\vec{i} + (3x^2 - z)\vec{j} + (3xz^2 - y)\vec{k}$ is irrotational vector and find the Scalar potential such that $\vec{F} = \nabla\phi$. CO2- App (8)
 (ii) Using Stokes theorem, evaluate $\int_C (x^2 - y^2)dx + 2xydy$ over CO2- App (8)
 $x = 0, x = a, y = 0, y = b$.

Or

- (b) Verify Gauss divergence theorem for the vector function $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ over the cube bounded by $x = 0, y = 0, z = 0$ and $x = 1, y = 1, z = 1$ CO2- App (16)
18. (a) (i) If $f(z) = u + iv$ is a regular function of z in a domain D the following relation hold in D . $\nabla^2 |f(z)|^2 = 4|f'(z)|^2$. CO3- App (8)
- (ii) Prove that $u = \frac{1}{2} \log(x^2 + y^2)$ is harmonic and determine its conjugate. Also find the corresponding analytic function. CO3- App (8)
- Or
- (b) (i) Determine the image of $|z - 1| = 1$ under the transformation $w = \frac{1}{z}$ CO3- App (8)
- (ii) Find the bilinear transformation from $-1, 0, 1$ to $0, i, 3i$ CO3- App (8)
19. (a) Using Contour integration Evaluate $\int_0^\infty \frac{x^2 dx}{(x^2 + 9)(x^2 + 25)}$ CO4- App (16)
- Or
- (b) (i) Find the Laurent's series of $f(z) = \frac{1}{(z - z^3)}$ valid in the region $1 < |z - 1| < 2$ CO4- App (8)
- (ii) Using Cauchy's Residue theorem CO4- App (8)
- Evaluate $\int_C \frac{1}{(z - 3)(z - 6)} dz$ where C is the circle $|z| = 5$
20. (a) (i) Solve : $(D^2 - 3DD' + 2D'^2)Z = e^{3x-2y} + \sin(3x + 2y)$ CO5- App (8)
- (ii) Solve : $x(y - z)p + y(z - x)q = z(x - y)$ CO5- App (8)
- Or
- (b) A tightly String with fixed end points $x=0$ and $x=l$ is initially at rest in its equilibrium position. If its set vibrating giving each point at velocity $\lambda(lx - x^2)$. Determine the displacement function $y(x, t)$ CO5- App (16)

