**A**            **Reg. No. :** ⬚⬚⬚⬚⬚⬚⬚⬚⬚⬚⬚⬚

## Question Paper Code: U2M04

B.E./B.Tech. DEGREE EXAMINATION, NOV 2022

Second Semester

Electronics and communication Engineering

21UMA204- Calculus,Complex analysis and Numerical methods

(Regulations 2021)

Duration: Three hours                                    Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The Particular integral of $y'' + 4y' + 4y = 0$ is _____          CO6-U

   (a) $xe^{-2x}$          (b) $xe^{2x}$          (c) $x^2e^{2x}$          (d) 0

2. The complementary function of $(4D^2- 3D-1 )y=2 \sin 2x$ is _____          CO6-U

   (a) $Ae^x + Be^{-\frac{x}{4}}$          (b) $Ae^{-x}+Be^{5x}$          (c) $(A+Bx)e^{2x}$          (d) $Ae^x+Be^{4x}$

3. $\text{Div}\,\bar{r}$ = ____          CO2-App

   (a) 0          (b)1          (c)3          (d) $\bar{r}$

4. Divergence of vector $x^2\bar{i} + y^2\bar{j} + z^2\bar{k}$ at (1, 2, -3) is _____          CO2-App

   (a) 8          (b)4          (c)-3          (d) 0

5. The critical point of the transformation $w = z + \frac{1}{z}$ are ____          CO3- App

   a) $\pm 1$          b) $\pm 2$          c) $\pm i$          d) $- i$

6. The function $f(z) = \frac{1}{z^2+4}$ is not analytic at $z =$ ____ .          CO3- App

   (a) 2          b) -2          c)2i          d)$\pm 2i$

7. If f(z) is analytic at all points inside and on a simple closed curve c, then $\int_c f(z)\,dz$ = ------          CO6-U

   (a) $2\pi i$          (b) $-2\pi i$          (c) $4\pi i$          (d) 0

8. Simple pole is a pole of order _____                                CO6-R

   (a)  1              (d)  2              (c)  3              (d)  4

9. Iteration method converges if $|g^1(x)|$ _____             CO6-R

   (a) >1              (b)<1              (c)=0              (d) >0

10. Gauss Jacobi iteration converges if the coefficient matrix is        CO6-U
    _____dominant

    (a) Squarely        (b) logically        (c) diagonally        (d) symmetrically

<p align="center">PART – B (5 x 2= 10Marks)</p>

11. Find the complete solution of $(D^3 – 6D^2 + 11D – 6)y = 0$             CO1-App

12. Find $\nabla\varphi$, if $\varphi = x^2 + y^2 + z^2$ at (1, -1, 1).              CO2-App

13. Find the fixed point of $w = \dfrac{2z - 5}{z + 4}$                         CO3-App

14. Evaluate $\int_c \dfrac{z}{z - 2}dz$ where C is $|z| = 2$                     CO4-App

15. State the principle used in Gauss Jordan Method                      CO5-U

<p align="center">PART – C (5 x 16= 80Marks)</p>

16. (a)  (i) Using method of variation of parameters solve $(D^2 +a^2)y = \cosec ax$     CO1-App    (8)

         (ii) A colony of bacteria is growing exponentially. At time t=0 it        CO1- App    (8)
         has 10 bacteria in it, and at time t=4 it has 2000. At what time
         will it have 100,000 bacteria?

<p align="center">Or</p>

    (b)  (i) Solve $(D^2 - 3D + 2)y = e^x + \cos 2x$                CO1- App    (8)

         (ii) Solve: $(x^2D^2 + xD )y = 12\log x$                   CO1- App    (8)

17. (a)  Verify Gauss Divergence theorem for $\vec{F} = x^2\vec{\imath} + y^2\vec{\jmath} + z^2\vec{k}$     CO2-App    (16)
         where $S$ is the surface of the cuboid formed by the planes
         $x = 0, x = a,$
         $y = 0, y = b, z = 0 \& z = c.$

<p align="center">Or</p>

    (b)  Verify Green's theorem for $\int_C x^2 dx + xy\, dy$ , whereC is bounded by        CO2 -App    (16)
         $x = 0,$
         $x = a, y = 0, y = a$

<p align="center">2</p>

18. (a) (i) Find the image of $|z - 3i| = 3$ under the transformation $w = \dfrac{1}{z}$  CO3-App (8)

(ii) 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)

Or

(b) (i) Find the bilinear transformation from -i,0,i to -1,i,1.  CO3-App (8)

(ii) Find the analytic functions f(z) = u +iv given that  CO3-App (8)

$2u + v = e^x (\cos\ y - \sin\ y)$

19. (a) (i) Evaluate using Cauchy's Residue theorem for  CO4-App (8)

$f(z) = \int_c \dfrac{3z^2 + z - 1}{(z^2 - 1)(z - 3)}\ dz$ , where 'C' is the circle $|z| = 2$.

(ii) Evaluate $f(z) = \dfrac{1}{(z+1)(z+3)}$ in Laurent series valid for the  CO4-App (8)

region  $1 < |z| < 3$.

Or

(b) Using contour integration, to find the value of $\displaystyle\int_0^{2\pi} \dfrac{d\theta}{13 - 5\cos\theta}$  CO4-App (16)

20. (a) (i) Solve the equation $x^3 - 2x - 5 = 0$ by iteration method  CO5-App (8)

(ii) Solve 4x + 2y +z = 14, x + 5y -z = 10, x + y + 8z =20 by Gauss Jordan method  CO5- App (8)

Or

(b) (i) Using power method find the largest Eigen value and the  CO5- App (8)

corresponding Eigen vector of the matrix $\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$

(ii) Solve by using convolution theorem Solve 28x+4y-z = 32; x+3y+10z = 24 ; 2x+17y+4z = 35 by Gauss - Seidel method  CO5- App (8)

**U2M04**