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Question Paper Code: U2M04

B.E./B.Tech. DEGREE EXAMINATION, MAY 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)

- $\frac{1}{(D-m)^2} e^{mx} = \underline{\hspace{2cm}}$ CO6-U
(a) $x e^{mx}$ (b) $x^2 e^{mx}$ (c) $\frac{x^2}{2} e^{mx}$ (d) $\frac{x^2}{m} e^{mx}$
- The complementary function of $(4D^2 - 3D - 1)y = 2 \sin 2x$ is $\underline{\hspace{2cm}}$ CO6-U
(a) $Ae^x + Be^{-\frac{x}{4}}$ (b) $Ae^{-x} + Be^{5x}$ (c) $(A+Bx)e^{2x}$ (d) $Ae^x + Be^{4x}$
- $\text{Div } \vec{r} = \underline{\hspace{2cm}}$ CO2-App
(a) 0 (b) 1 (c) 3 (d) \vec{r}
- Divergence of vector $x^2 \vec{i} + y^2 \vec{j} + z^2 \vec{k}$ at (1, 2, -3) is $\underline{\hspace{2cm}}$ CO2-App
(a) 8 (b) 4 (c) -3 (d) 0
- The critical point of the transformation $w = z + \frac{1}{z}$ are $\underline{\hspace{2cm}}$ CO3- App
(a) ± 1 (b) ± 2 (c) $\pm i$ (d) $-i$
- The function $f(z) = \frac{1}{z^2 + 4}$ is not analytic at $z = \underline{\hspace{2cm}}$ 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 $\int_c f(z) dz = \text{-----}$ 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 $|g'(x)|$ _____ CO6-R
- (a) >1 (b) <1 (c) $=0$ (d) >0
10. Order of convergence of iteration method is CO5-U
- (a) 1 (d) 2 (c) 3 (d) 0

PART – B (5 x 2= 10Marks)

11. Find Particular integral for $(D^2 - 2D + 1)y = \cosh x$. CO1-App
12. Find $\nabla\phi$, if $\phi = x^2 + y^2 + z^2$ at $(1, -1, 1)$. CO2-App
13. Find the fixed point of $w = \frac{2z - 5}{z + 4}$ CO3-App
14. Evaluate $\int_c \frac{z}{z - 2} dz$ where C is $|z| = 2$ CO4-App
15. State Newton's Iterative formula CO5-R

PART – C (5 x 16= 80Marks)

16. (a) (i) Using method of variation of parameters solve $(D^2 + a^2)y = \sec ax$ CO1-App (8)
- (ii) At the start of an experiment, there are 100 bacteria. If the bacteria follow an exponential growth pattern with rate $k = 0.02$. What will be the population after 5 hours? How long will it take for the population to double? CO1- App (8)
- Or
- (b) (i) Solve: $(x^2 D^2 - xD + 4)y = x^2 \sin(\log x)$ CO1- App (8)
- (ii) Solve: $(D^2 - 4D + 3)y = \cos 2x + e^{2x}$ CO1- App (8)
17. (a) Verify Gauss Divergence theorem for $\vec{F} = x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$ where S is the surface of the cuboid formed by the planes $x = 0, x = a,$
 $y = 0, y = b, z = 0$ & $z = c$. CO2-App (16)

Or

- (b) Verify Green's theorem for $\int_C x^2 dx + xy dy$, where C is bounded by $x = 0$, $x = a$, $y = 0$, $y = a$ CO2 -App (16)
18. (a) (i) Find the image of $|z - 3i| = 3$ under the transformation $w = \frac{1}{z}$ 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 $2u + v = e^x (\cos y - \sin y)$ CO3-App (8)
19. (a) (i) Evaluate using Cauchy's Residue theorem for $f(z) = \int_C \frac{3z^2 + z - 1}{(z^2 - 1)(z - 3)} dz$, where 'C' is the circle $|z| = 2$. CO4-App (8)
(ii) Evaluate $f(z) = \frac{1}{(z+1)(z+3)}$ in Laurent series valid for the region $1 < |z| < 3$. CO4-App (8)
- Or
- (b) Using contour integration, to find the value of $\int_0^{2\pi} \frac{d\theta}{13 - 5 \cos \theta}$ CO4-App (16)
20. (a) (i) Solve for a positive root of $3x - \cos x - 1 = 0$ by Newton's Raphson method. CO5-App (8)
(ii) Solve $4x + 2y + z = 14$, $x + 5y - z = 10$, $x + y + 8z = 20$ by Gauss Elimination method CO5- App (8)
- Or
- (b) (i) Using Power method find numerically largest Eigen value of $\begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$ CO5- App (8)
(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)

