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Question Paper Code:92007

B.E./B.Tech. DEGREE EXAMINATION, DEC 2021

Second Semester

19UMA207- Calculus, Complex Analysis and Transform Techniques

(Common to Agriculture, Biomedical, Biotechnology & Chemical Engineering)

(Regulation 2019)

Duration: Three hours

Maximum: 100 Marks

PART A

10*2 = 20 Marks

(Answer Any Ten of the following questions)

1. Solve $(D^3 + D^2 + 4D + 4)y = 0$ CO1- AP
2. Calculate the Particular integral of $(D^2 - 1)y = x$ CO1- AP
3. Compute the Wronskian of y_1, y_2 of $y'' - 2y' + y = e^x \log x$ CO1- AP
4. Determine the constant 'a,b,c' so that the vector $\vec{F} = (axy + bz^3)\vec{i} + (3x^2 - cz)\vec{j} + (3cz^2 - y)\vec{k}$ is Irrotational. CO2- AP
5. Calculate the Directional derivative of $\phi = 4xz^2 + x^2yz$ at $(1, -2, -1)$ in the direction $2\vec{i} + 3\vec{j} + 4\vec{k}$ CO2- AP
6. If $\phi = \log(x^2 + y^2 + z^2)$ then Compute $\nabla\phi$ at $(1, -1, 1)$ CO2- AP
7. Examine the function $f(x) = e^x (\cos y + i \sin y)$ is analytic or not. CO3- AP
8. State the necessary condition for $f(z)$ to be analytic. CO6- U
9. Calculate the fixed points of $w = \frac{z-1}{z+1}$. CO3- AP
10. Evaluate $\int_C \frac{z^2}{(z-1)^2(z+2)} dz$ where C is $|z|=3$ using Cauchy's Integral formula. CO4- AP
11. Expand $\frac{1}{z-2}$ at $z=1$ in a Taylor's series. CO4- AP

- 12 Calculate the residue of $f(z) = \frac{1 - e^{-z}}{z^3}$ at $z = 0$. CO4- AP
- 13 State the conditions under which Laplace Transform of $f(t)$ exists. CO6- U
- 14 Evaluate $L^{-1} \left[\log \left(\frac{s+1}{s-1} \right) \right]$ CO5- AP
- 15 Verify the Initial value theorem for $f(t) = 1 - e^{-at}$. CO5- AP

PART B

5*16 = 80 Marks

(Answer Any FIVE of the following questions)

16. Solve $[(x+1)^2 D^2 + (x+1)D + 1]y = 4 \cos [\log (x+1)]$ CO1-App (16)
- 17 Verify Gauss Divergence Theorem for $\vec{F} = 4xz \vec{i} - y^2 \vec{j} + yz \vec{k}$ over the cube $x = 0, x = 1, y = 0, y = 1, z = 0, z = 1$. CO2-App (16)
- 18 Determine the bilinear transformation that maps the points $0, -1, i$ in the z -plane onto the points $i, 0, \infty$ in the w -plane. CO3- App (16)
- 19 Using contour integration, Evaluate $\int_0^{2\pi} \frac{1}{13 + 5 \sin \theta} d\theta$ CO4- App (16)
- 20 Find the Laplace transform of $f(t) = \begin{cases} k, & 0 \leq t \leq a \\ -k, & a \leq t \leq 2a \end{cases}$ CO5- App (16)
- 21 Solve $(D^2 + a^2)y = \tan ax$, using method of variation of parameters CO1-App (16)
- 22 Prove that $\vec{F} = (y^2 \cos z + z^3) \vec{i} + (2y \sin x - 4) \vec{j} + 3xz^2 \vec{k}$ is irrotational and also find its scalar potential. CO1-App (16)
- 23 Solve by using convolution theorem $L^{-1} \left[\frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \right]$ CO5- App (16)

