NATIONAL ACADEMY DHARMAPURI

PG TRB MATHS

MATERIALS

&

QUESTION PAPERS

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NATIONAL ACADEMY- DHARMAPURI
PG- TRB MATHEMATICS
Max.Mark :50 COMPLEX ANALYSIS Time : 1hour

1.The function $\boldsymbol{\omega} = \frac{z^2+1}{z^2-1}$ is analytic

(a) For all z (b) For all z except (1,0) ,(-1,0)

(c) For all z except (0,1) ,(0,-1) (d) For all z except (0,1) ,(1,2)

2. If f(z) and f($\bar{z}$) are analytic ,then

(a) f(z) is constant (b) f(z) is not constant (c) f(z) is not analytic (d) $|f(z)|$ is not constant

3. The Cartesian form of C.R equation is

(a) $u_x=-v_y$, $u_y = v_x$ (b) $u_r = v_\theta$, $u_\theta = -v_r$ (c) $u_x = v_y$, $u_y = -v_x$ (d) $u_y = -v_y, u_y = v_x$

4. If $f(z) = \begin{cases} \frac{Re(z)}{|z|}, & at\ z \neq 0 \\ 0, & at\ z = 0 \end{cases}$ Then at z= 0 is

(a) diffrantiable at z=0 (b) continuous at z=0

(c) not diffrantiable at z=0 (d) not diffrantiable and not continuous at z=0

5. If $u = y^3-3x^2y$ then f(z) is

(a) $f(z) = iz^3+c$ (b) $-iz^3+c$ (c) z^3+c (d) iz^3+1

6. $u = e^x \sin y$ is harmonic ,the value of v is

(a) $-e^x\cos y+c$ (b) $-2e^x\cos y+c$ (c) $2e^x\cos y+c$ (d) $-2e^x\sin y$

7. Let R(z) be a rational function of order 6,Then R(z) has

(a) 3 zeros ,6 poles (b) 12 zeros ,12 poles (c) 6 zeros ,3 poles (d) 6 zeros ,6 poles

8. If $\lim_{n\to\infty} Zn = A$,Then $\lim_{n\to\infty} \frac{1}{n}(Z1 + Z2 + \cdots + Zn)$ is

(a) $\frac{1}{A}$ (b) A (c) $\frac{1}{n}$ (d) $\frac{1}{n}A$

9. If all zeros of a polynomial p(z) lie in the lower halfplane, then all zeroes of $p^1(z)$ lies in

(a) complex plane (b) upper half plane (c) lower half plane (d) real plane

10. Which one of the following is not a bilinear transformation

(a) 3z+4 (b) $\frac{3z+4}{5z+6}$ (c) $\frac{z+1}{z-1}$ (d) $\frac{z+3}{2z+6}$

11. The radius of convergence of the power series $\sum_{n=1}^{\infty} \frac{n!}{2^n} z^n$ is

(a) e (b) $\frac{1}{e}$ (c) 0 (d) ∞

12. The radius convergence of $\sum_{n=1}^{\infty} \frac{2^n}{n!} z^n$ is

(a) R = 0 (b) R = ∞ (c) R = e (d) R = $\frac{1}{e}$

13. conformal mapping preserves

(a) direction only (b) magnitude only (c) magnitude and direction (d) None of these

14. If w =kz and $|k|$= 1,then w is called

(a) inversion (b) Rotation (c) parallel translation (d) homothetic

15. The cross ratio (z_1,z_2,z_3,z_4) is real if and only if the four points are

(a) lies on a cicle only (b) lie on a cicle or straight line

(c) lie on a straight line only (d) lie on a sphere

16. The fixed point of w = z+3 is

(a) ∞ (b) 0 (c) undefine (d) – 3

17. An arc z = z(t) is rectifiable $\Leftrightarrow$ the real and imaginary parts of z(t) are

(a) not bounded (b) equal (c) not equal (d) bounded variation

18. Which one of the following mapping is conformal

(a) w =z^3 (b) w = z+$\frac{1}{z}$ (c) w = e^z (d) None

19. Which one of the following is correct

(a) $\int_\gamma \frac{dz}{z-a}$ is a multible of $3\pi i$

(b) If γ lies inside a circle ,then n$(\gamma, a) = 0$ where a is outside of the circle

(c) winding no is not an integer (d) 'a' lies inside the circle and γ lies out side the n$(\gamma, a) = 0$

20. Let n(γ, a) be a winding number of γ with respect to 'a' ,then n(γ, a)

(a) - n(γ, a) (b) - n($-\gamma, a$) (c) n($-\gamma, a$) (d) 0

21. If $\lim_{z\to a} f(z) = \infty$, then a is

(a) zero (b) essential singularity (c) pole (d) Isolated E.S

22. A function which is analytic and bounded in the whole plane, then

(a) it is a constant (b) not constant (c) purely real (d) purely imaginary

23. The value of $\int_{|z|=2} \frac{dz}{z-1}$ is (a) 0 (b) π (c) 2 πi (d)- 2 πi

24. f(z) is analytic in Ω and f(z) is analytic then $|f(z)|$ has

(a) max on the boundary only (b) max inside the rigion Ω only

(c) max inside and on the boundary (d) None

25. residue of f(z) = $\frac{1}{z^2+1}$ at z =i is

(a) 2i (b) -2i (c)- $\frac{1}{2i}$ (d) $\frac{1}{2i}$

26. The meclaurins series of e^{2z} is

(a) $\sum_{n=0}^{\infty} \frac{z^n}{2n!}$ (b) $\sum_{n=0}^{\infty} \frac{(2z)^n}{n!}$ (c) $\sum_{n=1}^{\infty} \frac{(2z)^n}{n!}$ (d) $\sum_{n=1}^{\infty} \frac{(z/2)^n}{2n!}$

27. Moreras theorem is the convers of

(a) couchy Goursat theorem (b) Liovilles theorem

(c) Cauchy intergral theorem (d) Fundamental theorem of algebra

28. If f(z) is analytic with in and on C and z=a lies inside c, then $\int_c \frac{f(z)}{z-a}$dz is

(a) 0 (b) $2\pi i \times f(a)$ (c) $2\pi i f^1$(a) (d) $2\pi i$

29. Let f(z) = $\frac{1}{sinhz}$ be a meromorphic in the complex plane. The limit point of the pole of this function is

(a) π (b)0 (c)1 (d) ∞

30. The function e^z ,sinz and cosz have common essential singularity

(a) ∞ (b) 0 (c) 1 (d) π

31. The cross ratio of 1,2,3,4 is

(a) $\frac{-1}{3}$ (b) $\frac{1}{3}$ (c) 0 (d) ∞

32. The number of zero of f(z) = z4-5z+1 in 1< $|z|<2$ is

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

33. If f(z)=$\frac{z-sinz}{z^3}$,then z=0 is

(a) Essential singularities (b) Removable singularity (c) pole (d) I.E.S

34. The bilinear maps which maps(0,-i,-1) to(i,1,0) is

(a) w =$\frac{z+1}{i(z-1)}$ (b) w =$\frac{z+1}{(z-1)}$ (c) w =$\frac{z-1}{(z+1)}$ (d) w =$\frac{i(z+1)}{-z+1}$

35. The series $\frac{1}{3-z}$ is valid for

(a) $\left|\frac{3}{z}\right|<1$ (b) $\left|\frac{z}{3}\right|<1$ (c) $\left|\frac{3}{z}\right|>1$ and $\left|\frac{z}{3}\right|>1$ (d) $\left|\frac{z}{3}\right|>1$ and $\left|\frac{3}{z}\right|<1$

36. The condition for the existance of finite derivative of f(z)

(a) continuity is necessary (b) continuity is sufficient

(c) continuity is necessary and sufficient (d) continuity is not necessary and sufficient

37. If then Laurentz series expansion of f(z) about $z_0$can be expressed as f(z) = $\sum_{n=0}^{\infty} a_n\,(z-z_0)^n$ then a_n is

(a)$\frac{1}{2\pi i}\int_c \frac{f(z)dz}{(z-z_0)^{-n+1}}$ (b) $\frac{1}{2\pi i}\int_c \frac{f(z)dz}{(z-z_0)^{n+1}}$ (c) $\int_c \frac{f(z)dz}{(z-z_0)^{n+1}}$ (d) $\int_c \frac{f(z)dz}{(z-z_0)^{-n+1}}$

38. The value of the integral $\int_c \frac{dz}{z-3}$, where c:$|z-1|$=3 is

(a) $2\pi i$ (b) -$2\pi i$ (c) 0 (d)∞

39. If f(z) and g(z) are analytic inside and on simple closed contour c and if $|g(z)|<|f(z)|$ on C. Then f(z)+g(z) and f(z) have same number of zeroes in C.this is due to

(a) Rouches theorem (b) moreras theorem (c) Cauchy theorem (d) Liovilles theorem

40. If f(z) is analytic on a rectangle R, then $\int_{\partial R} f(z)dz$ is

(a) area of R (b) 0 (c) ∞ (d) 1

41. The Geometric series 1+z+z^2+z^3+… convergens to

(a) $\frac{1}{1-z}$ if $|z| > 1$ (b) $\frac{1}{1-z}$ if $|z| < 1$ (c) $\frac{1}{1-z}$ if $|z| = 1$ (d) $None$

42. f(z) = $\frac{e^z}{z^2}$ find the nature of the singularities at z = 0

(a) Essential singularity (b) simple pole at z = 0 (c) double pole at z = 0 (d) Isolated essential

43. The nature of the singularities f(z) = $\frac{e^{-2z}}{z^3}$ at z = 0 is

(a) z = 0 is a pole of order 3 (b) z =0 is a double pole

(c) z = 0 is E.S (d) z = 0 is a removable singularities

44. f(z) = $\frac{sinz}{z}$, the singularity at z = 0

(a) Essential singularity at z = 0 (b) Removable singularity at z = 0 (c) pole at z = 0

(d) None

45. An integral depends only on the end points iff the integral over any closed curve is,

(a) 0 (b) 1 (c)∞ (d) $2\pi i$

46.The Cauchy integral formula appears if the winding number is

(a) $\text{n}(\gamma, n) = 0$ (b) $\text{n}(\gamma, a) = 1$ (c) $\text{n}(\gamma, a) = -\text{n}(\gamma, a)$ (d) ∞

47. Find the residue of f(z) = $\frac{1}{z(z-7)^3}$ at z = 7 is

(a) $\frac{-1}{343}$ (b) $\frac{2}{343}$ (c) $\frac{1}{343}$ (d) $\frac{-2}{343}$

48. If f(z) = $\frac{1-e^{2z}}{z^4}$ if z =0 is pole of order 3 and its residue is

(a) $\frac{-4}{3}$ (b) $\frac{4}{3}$ (c) $\frac{2}{3}$ (d) $\frac{-2}{3}$

49. A bilinear transformation having one fixed point called

(a) elliptic transformation (b) hyperbolic transformation

(c) lexodromic (d) parabolic transformation

50. The radius of convergence of $\sum_{n=1}^{\infty} \frac{z^n}{n+1}$ is

0000 (a) 0 (b) ∞ (c) 1 (d) -1

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COMPLEX ANALYSIS
ANSWER KEY

Qn.NO	KEY	Qn.NO	KEY
1	B	26	B
2	A	27	A
3	C	28	B
4	D	29	D
5	A	30	A
6	A	31	A
7	D	32	A
8	B	33	B
9	C	34	A
10	A	35	B
11	C	36	A
12	B	37	B
13	C	38	A
14	B	39	A
15	B	40	B
16	A	41	B
17	D	42	C
18	C	43	A
19	B	44	B
20	B	45	A
21	C	46	B
22	A	47	C
23	C	48	A
24	A	49	D
25	D	50	C

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