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COURSE: B.TECH. SEMESTER: II
SUBJECT: ENGINEERING MATHEMATICS II SUBJECT CODE: KAS-203T

MODULE-4
COMPLEX VARIABLE – DIFFERENTIATION
MULTIPLE CHOICE QUESTIONS

1. The conjugate harmonic function of $e^{x}cosy$ is …………….

(a) $e^{x}cosy$ + c (b) $e^{x}siny$ + c (c) e^{x}+ c (d) None of these

2. The harmonic conjugate of $e^{-y}sinx$ is …………….

(a) $e^{-y}cosx$ + c (b) $e^{-y}sinx$ + c (c) $e^{-x}cosy$ (d) None of these

3. If f(z) = u + iv is an analytic function then u and v both satisfy Laplace's equation.

(a) Statement is correct (b) Statement is false (c) None

4. A function f(z) = e^{z} is……..

(a) Analytic everywhere (b) Analytic nowhere (c) only differentiable (d) None

5. If f(z) = u + iv is an analytic fn. in the z-plane, then the C-R equations are satisfied by it's real and imaginary parts i.e …….

(a) $u_x = v_y, u_y = -v_x$ (b) $u_x = -v_y, u_y = v_x$

(c) $u_y = -v_x, u_y = -v_x$ (d) $u_x = v_x, u_y = -v_y$

6. Milne- Thomson method is used to construct …….

a) analytic function b) Continuous function

c) differentiable function d) None of these.

7. Write the Milne-Thomson's method to construct an analytic function F(z) = u + iv when the real part u is given:….

a) $\int\{\emptyset_1(z,0) + i\emptyset_2(z,0)\}\,dz + c$ b) $\int\{\emptyset_1(z,0) - i\emptyset_2(z,0)\}\,dz + c$

c) $\int\{\emptyset_2(z,0) - i\emptyset_1(z,0)\}\,dz + c$ d) None of these.

8. Let $f(z) = u + iv$ be a complex valued function. Where $v = 3xy^2$, then f is analytic for any value of u

a) f is analytic for suitable value of u

b) f is analytic only when $u =$ constant

c) f can't be analytic for any value of u.

9. The value of 's' such that $f(z) = \frac{1}{2}log(x^2 + y^2) + i\,tan^{-1}\frac{sx}{y}$ is an analytic function.

a) 1 b) 2 c) $\pi/2$ d) $\frac{1}{2}$

10. If a function $f(z)$ is continuous at z_0, then

a) $f(z)$ is differentiable at z_0

b) $f(z)$ is not necessarily differentiable at z_0

c) $f(z)$ is analytic at z_0.

d) None of the above.

11. The only function among the following that's analytic, is

$a)\ f(z) = Re(z)$ b) $f(z) = Im(z)$ c) $f(z) = \bar{z}$ d) $f(z) = sin\, z4$.

12. An analytic function is

a) Infinitely differentiable

b) not necessarily differentiable

c) finitely differentiable.

d) None of these.

13. Let $u(x, y) = 2x(1 - y)$, for all real x and y then the imaginary part of u, such that $f(z) = u(x, y) + i\ v(x, y)$ is analytic, is

a) $x^2 - (y - 1)^2$

b) $(x - 1)^2 - y^2$

c) $(x - 1)^2 + y^2$

d) $x^2 + (y - 1)^2$

14. Which of the following can not be the real part of an analytic function.

a) $x^2 - y^2$ b) $x^2 + y^2$ c) $cos\, x\, cosh\, y$ d) $\frac{1}{2}log(x^2 + y^2)$

15. The harmonic conjugate of $u(x, y) = (x - 1)^3 - 3xy^2 + 3y^2$ is

a) $3y(1 + x^2) - y^3$

b) $3x(1 + y^2)$

c) $(y - 1)^{-3} + 3xy^2 - 3y^2$

d) $(x - 1)^3 i + 3xy^2 i - 3y^2 i$

16. The invariant points of the transformation $w = \frac{1+z}{1-z}$ are

a) $i,\ i$ b) $i,\ -i$ c) $1 - i,\ 1 + i$ d) $-i,\ -1 + i$

17. Under the mapping $w = z + 2 - i$, the image of line $y = 0$ is,

a) $Im(w) = 1$ b) $Im(w) = -1$ c) $Re(w) = 1$ d) $Re(w) = -1$

18. The mapping $f(z) = \bar{z}$ is

a) Conformal b) isogonal c) neither conformal nor isogonal d) analytic

19. The bilinear transformation w which maps the point $0,\ 1,\ \infty$ in the z −plane onto the points-$i,\ \infty,\ 1$ in w −plane is

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

20. A function f(z) may be differentiable in a domain except for a finite number of points, these points are called…..

a) Isolated points b) Invariant points c) Singular points d) Conjugate points

21. The points which coincide with their transformations are called………and can be obtained by the condition…..

a) Singular points, f(z)=w b) Isolated points, f'(z)=z

c) Conjugate points, f(z)=0 d) Invariant points, f(z)=z

22. A transformation w=$\frac{az+b}{cz+d}$ is known as……

a) Mobius transformation b) Linear transformation

c) Inverse transformation d) Mapping

23. The image of the circle $|z-1| = 1$ in complex plane under the transformation wz=1 is….

a) v=$\frac{1}{2}$ b) v=$\frac{-1}{2}$ c) u=$\frac{1}{2}$ d) u$\neq \frac{1}{2}$

24. The transformation $w = e^{i\theta}$ represents….

a) Magnification b) Rotation c) Translation d) Inversion

25. Angle of rotation and coefficient of magnification are given by….

a) $amp. |f'(a-ib)|, |f'(a+ib)|$ b) $amp. |f'(a+ib)|, \ |f'(a-ib)|$
c) $amp. |f'(a+ib)|, |f(a+ib)|$ d) $amp. |f'(a+ib)|, \ |f'(a+ib)|$

26. "If function f(z) & g(z) are analytic within & on a closed curve C and $|g(z)| < |f(z)|$ on C then f(z) & f(z)+g(z) have same number of zeros inside C" this statement is known as…

a) Liouville's theorem b) Cauchy's theorem

c) fundamental theorem of algebra d) Rouche's theorem

27. A transform $w = \frac{az+b}{cz+d}$ is called Bilinear Transformation, if

(a) $ac - bd \neq 0$
(b) $ad - bc \neq 0$
(c) $ad - bc = 0$
(d) $ab - cd \neq 0$

28. Under the transformation $w = \frac{1}{z}$, the image of the line $y = \frac{1}{4}$ in z-plane is

(a) $u^2 + v^2 = 2$

(b) $u^2 + v^2 + 4v = 0$
(c) $u^2 + v^2 = 4$
(d) None

29. Under the transformation $w = z + 1 - i$ the image of the line y=0 in the z-plane is

(a) v=-1
(b) v=1
(c) u = 1
(d) u = -1

30. A mobius transformation maps circle into

(a) Straight line
(b) Circle
(c) Parabola
(d) none

31. The Bilinear Transformation that maps the points $(\infty, i, 0)$ *into the points* $(0. i. \infty)$ *is*

(a) $w\,z = 1$
(b) $w = z$
(c) $w = -z$
(d) $w\,z = -1$

32. The condition of a conformal mapping in terms of Jacobian is given by

(a) $J\left(\frac{u,v}{x,y}\right) \neq 0$
(b) $J\left(\frac{u,v}{x,y}\right) = 0$
(c) $J\left(\frac{x,y}{u,v}\right) \neq 0$
(d) None

33. The Bilinear Transformation which carries 0, i,-i into 1,-1,0 respectively is given by

(a) $w = \frac{z+i}{3z+i}$
(b) $w = \frac{z+i}{i-3z}$
(c) $w = \frac{z-i}{3z-i}$
(d) $w = \frac{z-i}{3z+i}$

34. The transformation $w = \frac{az+b}{cz+d}$ transform the unit circle in the w-plane into straight line in z-plane if

(a) $a = c$
(b) $|a| = |c|$
(c) $|a| = |b|$

(d) None

35. The transformation $w = \frac{az+b}{cz+d}$ is said to be normalized if ad-bc is equal to

(a) 0
(b) 1
(c) ∞
(d) None

36. $z = \frac{2w+5}{4(w+1)}$ under the transformation $|z| = 1$ transform into

(a) $u^2 + v^2 = 4$

(b) $u^2 + v^2 + u - \frac{3}{4} = 0$

(c) $u^2 + v^2 = 1$

(d) None

37. The Bilinear transformation $w = \frac{ax+b}{cx+d}$ having only one fixed point then it is called

(a) Parabolic

(b) Hyperbolic

(c) circle

(d) none

38. A Bilinear transformation having two fixed point as p and q then which is true

(a) $\frac{w-p}{w-q} = \frac{z-p}{z-q}\ k$

(b) $\frac{w-p}{q-w} = \frac{z-p}{p-w}\ k$

(c) w= pqz

(d) None

39. A Bilinear transformation $\frac{w-p}{w-q} = \frac{z-p}{z-q}\ k$ is called Elliptic if

(a) $|k| = 1$

(b) $|k| < 1$

(c) $|k| > 1$

(d) None

40. A Bilinear transformation $\frac{w-p}{w-q} = \frac{z-p}{z-q}\ k$ is called Hyperbolic if

(a) $|k| = 1$

(b) $|k| < 1$

(c) $|k| > 1$

(d) k is Real

41. A Bilinear transformation is neither hyperbolic nor Elliptic or parabolic is called

(a) Orthogonal

(b) Normalized

(c) loxodromic

(d) none

42. Which is not meaning to an Analytic function.

(a) Regular Function

(b) Harmonic Function

(d) Holomorphic Function

(d) Monogenic Function

43. which are the correct C-R equations

(a) $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$ & $\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$

(b) $\frac{\partial u}{\partial y} = \frac{\partial v}{\partial x}$ & $\frac{\partial u}{\partial x} = -\frac{\partial v}{\partial y}$

(c) $\frac{\partial u}{\partial y} = \frac{\partial v}{\partial y}$ & $\frac{\partial u}{\partial x} = -\frac{\partial v}{\partial x}$

(d) None

44. C-R equation are the condition of an analytic function

(a) Sufficient

(b) Necessary

(c) a & b

(d) None

45. if $V = \tan^{-1}\frac{y}{x}$ is a part of an analytic function then f(z) will be

(a) logz +c

(b) log $|z|$ +c

(c) sinz +c

(d) None

46. At which point for $f(z) = \sqrt{|xy|}$ is satisfied C-R equation

(a) (0,0)

(b) (1,1)

(c) (0,1)

(d) (1,0)

47. for what value of a and b $f(z) = a\log(x^2 + y^2) + i\ \tan^{-1}\frac{by}{x}$ is an analytic function

(a) $\frac{1}{2}, 1$

(b) $\frac{1}{2}, -1$

(c) $-\frac{1}{2}, 1$

(d) None

48. Find image of $|z - i| = 1$ under the mapping wz=1

(a) 2v+1=0

(b) 2v-1=0

(c) u=v

(d) None

49. Which of the following is a Bilinear transformation

(a) w = z

(b) $w = \frac{2z+1}{4z+2}$

(c) $w = \frac{z(1+i)+1}{2z+(1-i)}$

(d) None

50. If f(z) is analytic then f'(z) is:

a) $\frac{\partial u}{\partial x} + i\frac{\partial v}{\partial x}$

b) $\frac{\partial u}{\partial y} + i\frac{\partial v}{\partial y}$

c) $\frac{\partial u}{\partial x} - i\frac{\partial v}{\partial x}$

d) $\frac{\partial u}{\partial y} - i\frac{\partial v}{\partial y}$.

51. CR equations for w = u+ i v are:

a) $u_x = v_x, u_y = v_y$.

b) $u_x = v_y, u_y = -v_x$

c) $u_x = v_y, u_y = v_x$.

d) $u_x = -v_y,\ u_y = v_x$

52. Which is correct for w=f(z):

a) $\frac{dw}{dz} = \frac{\partial w}{\partial x}$

b) $\frac{dw}{dz} = -\frac{\partial w}{\partial x}$

c) $\frac{dw}{dz} = \frac{\partial w}{\partial y}$.

d) $\frac{dw}{dz} = -\frac{\partial w}{\partial y}$

53.A function u(x,y) is harmonic if:

a) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 v}{\partial x^2} = 0$

b) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = 0$

c) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$

d) None

54. A derivative of f(z) = log z is:

a) z

b) $\frac{1}{z}$

c) 0

d) none.

55.f(z)= u+iv is analytic iff u and v are:

a) harmonic.

b) continuous.

c) differentiable.

d) satisfies CR equation.

56.If f is analytic in domain D, then in that domain

a) f is continuous only.

b) f is differentiable only.

c) both a and b.

d) None

57.If w = f(z) is conformal mapping in D, then f(z) is:

a) analytic in D.

b) not always analytic

c) never analytic.

d) none

58.The bilinear transformation which maps $z = 1,\ z = 0,\ z = -1$ onto $w = i,\ w = 0,\ w = -i$ is

a) $w = iz$
b) $w = z$
c) $w = i(z+1)$.
d) none

59.Which is analytic function?
a) $\sin z$.
b) $\bar{z}$.
c) $Im.(\bar{z})$.
d) $Re(iz)$.

60.A function *f*(*z*) is analytic function if
a) Real part of *f*(*z*) is analytic
b) Imaginary part of *f*(*z*) is analytic
c) Both real and imaginary part of *f*(*z*) is analytic
d) none of the above

61.If f (z) = x + αy + i (βx + γy) is analytic then α, β,γ equals to
a) $\gamma = 1$ and $\alpha = -\beta$
b) $\beta = 1$ and $\alpha = -\gamma$
c) $\alpha = 1$ and $\gamma = -\beta$
d) $\alpha = \beta = \gamma = 1$

62.Harmonic conjugate of u(x,y) = $e^y \cos x$ is
a) $e^x \cos y + C$
b) $e^x \sin y + C$
c) $e^y \sin x + C$
d) $-e^y \sin x + C$

63.If the real part of an analytic function f (z) = $x^2 - y^2 - y$, then the imaginary part is
a) 2xy b) x^2+2xy c) 2xy–y d) 2xy +x

64.There exist no analytic function *f* such that
a) Re f (z) = y - 2x b) Re f (z) = y^2 - 2x c) Re f (z) = $y^2 - x^2$ d)Re f (z) = y – x

65.If $f(z) = \frac{xy}{(x^2+y^2)}$, $if\ z \neq 0$ and f(0) = 0 then f(z) is
a) Continuous but not differentiable at z = 0 b) differentiable at z = 0
c) Analytic everywhere except at z = 0 d) not differentiable at z = 0

66.The function e^x (cos*y*- i sin*y*) is
(a) Analytic (b) not analytic (c) analytic when z = 0 (d) analytic when z = i

67.Harmonic conjugate of u = log $\sqrt{x^2+y^2}$ is
a) $\frac{x}{(x^2+y^2)}$ b) $\frac{y}{(x^2+y^2)}$ c) $\tan^{-1}(\frac{x}{y})$ d) $\tan^{-1}(\frac{y}{x})$

68.f (z) =$|\bar{z}|^2$ is differentiable

a) nowhere b) only at z = 0 c) everywhere d) only at z = 1

69.w = $\frac{a+bz}{c+dz}$ is a bilinear transformation when

a) ad – bc = 0 b)ad – bc≠ 0 c) ab – cd ≠ 0 d) None of these

70.A mapping that preserves angles between oriented curves both in magnitude and in sense is called

a) informal b) isogonal c) conformal d) formal

71.f(z) = e^z is analytic

a) only at z = 0 b) only at z = i c) nowhere d) everywhere

72.The points that coincide with their transformation are known as

a) fixed points b) critical points c) singular points d) None of these invar.

73.The fixed points of the transformation w = z^2 are

a) 0,-1 b) 0,1 c) -1,1 d) – i , i

74.The invariant points of the mapping w = $\frac{z}{2-z}$are

a) 1, -1 b) 0,-1 c) 0,1 d) – 1 , -1