$Test\ no:\ 1$ ($Complex\ numbers$)

1. The amplitude of a complex number i is

a) 0 b) $\pi/2$ c) π d) 2π

2.The amplitude of the quotient of two complex numbers is

a) the sum of their amplitudes b) the difference of their amplitudes

c) the product of their amplitudes d) the quotient of their amplitudes

3. The $z = x + iy$ then $\bar{z} =$

a) $x^2 + y^2$ b) $x^2 + iy^2$ c) $x^2 - y^2$ d) imaginary

4. If z_1 & z_2 are any two complex numbers, then $\frac{|z_1 + z_2|}{|z_1.z_2|}$ is

a) $\frac{|z_1 + z_2|}{|z_2|}$ b) $\frac{|z_1 + z_2|}{|z_1.|}$ c) $\frac{|z_1 + z_2|}{|z_2||z_1|}$ d) $\frac{|1|}{|z_1|}$ $\frac{|1|}{|z_2|}$

5.$\lim_{z\to 2i}(2x + iy^2)^2 =$

a) $8i$ b) $-8i$ c) 16 d) $4i$

6.The equation $|z + 4i| + |z - 4i| = 10$ represents

a) Circle b) ellipse c) parabola d) hyperbola

7.The equation $|z + 5i| = |z - 5i|$ represents

a) Circle b) ellipse c) parabola d) Real axis

8.The equation $|z + 1| = \sqrt{2}|z - 1|$ represents

a) Circle b) ellipse c) parabola d) hyperbola

9.The equation $|z + 2| + |z - 2| = 4$ represents

a) Circle b) a st. line c) parabola d) hyperbola

10.The equation $|2z - 1| = |z - 2|$ represents

a) Circle b) a st. line c) parabola d) hyperbola

11.The equation $|z - 1|^2 + |z - 2|^2 = 4$ represents

a) Circle b) a st. line c) parabola d) hyperbola

12.The equation $arg\left(\frac{z-a}{z-b}\right) = k$ represents

a) Circle b) a st. line c) parabola d) hyperbola

13.The equation $arg\left(\frac{z-1}{z+1}\right) = \pi/3$ represents

a) Circle b) a st. line c) parabola d) hyperbola

14. Let $f(z) = \begin{cases} \frac{Re\, z}{|z|} & , z \neq 0 \\ 0 \;, & z = 0 \end{cases}$ and $g(z) = \begin{cases} \frac{x^3(1+i) - y^3(1-i)}{x^2+y^2} & , z \neq 0 \\ 0 & , z = 0 \end{cases}$

a) both f(z) & g(z) are continues at the origin

b) both f(z) & g(z) are not continues at the origin

c) f(z) continues at the origin & g(z) is not continues at the origin

d) f(z) is not continues at the origin & g(z) is continues at the origin

15.The multiplicative identity if C is

a)(0,0) b) (1,1) c) (0,1) d) (1,0)

16. $\left(\frac{1+\cos\frac{\pi}{8}+i\sin\frac{\pi}{8}}{1+\cos\frac{\pi}{8}-i\sin\frac{\pi}{8}}\right)^8 =$

a) 1+i b) 1-i c) 1 d) -1

17. If α is a complex number such that $\alpha^2 + \alpha + 1 = 0$ then $\alpha^{31} =$

a) α b) α^2 c) 0 d) 1

18. If p is a complex number & $|q| = 1$ then $\left|\frac{p-q}{\bar{p}q-1}\right|$ is

a) i b) -i c) 1 d) -1

19. .$\lim_{z\to 2}\left(\frac{z^2-4}{z-2}\right) =$

a) 2 b) 4 c) 1 d) 8

20. If z_1 & z_2 are the image of the complex plane of two diametrically opposite point on the Rieman's sphere then $\overline{z_1 z_2}$ is

a) 0 b) 1 c) -1 d) i

Answer key :

1	6	11	16	21
2	7	12	17	22
3	8	13	18	23
4	9	14	19	24
5	10	15	20	25

$Test\ no: 2$ ($Analytic\ functions$)

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

a) for all z b) for all z except 1,-1 c) for all z except $i, -i$ d) for all z except $1 + 2i$

2. Which of the following is not an entire function ?

a) e^z b) e^{-z} c) $z^2 - 1$ d) $\log z$

3. Which of the following is called C-R equation for the function $f(z) = u + iv$ to be analytic at z ?

a) $u_x = -v_y$ & $u_y = v_x$ b) $u_x = v_y$ & $u_y = -v_x$ c) $u_x = v_y$ & $u_y = v_x$ d) $u_x = -v_x$ & $u_y = v_y$

4. Which of the following is called C-R equation for polar coordinates ?

a) $u_r = v_\theta$ & $u_\theta = -v_r$ b) $u_r = \frac{1}{r}v_\theta$ & $\frac{1}{r}u_\theta = v_r$

c) $u_r = \frac{1}{r}v_\theta$ & $\frac{1}{r}u_\theta = -v_r$ d) $\frac{1}{r}u_r = v_\theta$ & $\frac{1}{r}u_\theta = v_r$

5.Define $f(z) = \frac{\sin z}{z}$ z≠0 then

a) $\lim_{z\to 0} f(z)$ does not exists b) f(z) is continues at z=0

b) f(z) does not continues at z=0 d) $\lim_{z\to 0} f(z) = 1$

6.For the function $f(z) = u + iv$ to be differentiable

a) necessary & sufficient b) necessary & not sufficient

b) not necessary & sufficient d) none

12.For the function $f(z) = u + iv$ to be differentiable ,which of the following is true

a) u_x, v_y, u_y, v_x exists b) $u_x = v_y$ & $u_y = -v_x$ holds

b) u_x, v_y, u_y, v_x exists & continuous d) all

7. Let $f(z) = \begin{cases} \frac{\sin z}{z} & , z \neq 0 \\ 1 \quad , & z = 0 \end{cases}$ then f(z) at z=0

a) f(z) continues b) f(z) not continues c) f(z) is well d) none

8.For the function f(z) .a point z_0 is said to be singular point if

a) f(z) is analytic at z_0 b) f(z) is not analytic at z_0 c) f(z) is continues at z_0 n) none

9.For the function $f(z) = \frac{(z+2)^3}{(z-2)(z-1)^2}$ which of the following is true

a) z = -2 is a zero of order 3 b) a) z = 1 is a pole of order 2 c) a) z = 2 is a pole of order d) all

10.For the function $f(z) = \bar{z}$ is

a) entire function b) differentiable at z =2 c) a) z = 2 is a pole of order d) all

11. If $f(z) = a(x^2 - y^2) + ibxy + c$ is differentiable at every point ,the constants

a) 2b=a b) 4b=a c) 2a=b d) a=b

12.The function $f(z) = |z|^2$ is

a) differentiable at $z = 0$ b) no where differentiable c) not harmonic d) differentiable at $z \neq 0$

13.If $f(z) = u + iv$ is analytic & $u = 2x(1 - y)$ then $f(z) =$

a) $2z + iz^2$ b) $2z - iz^2$ c) $z + iz^2/2$ d) $z - iz^2/2$

14.If $f(z) = u + iv$ is analytic & $v = 2xy$ then $f(z) =$

a) $z^4 + c$ b) $z^2 + c$ c) $z + c$ d) $z - iz^2/2$

15. If $f(z) = (x^2 + ay^2 - 2xy) + i(bx^2 - y^2 + 2xy)$ is analytic ,then the value of a, b are respectually

a) -1,1 b) -1,2 c) 1,-1 c) 2,-1

16. If $f(z) = a(x^2 - y^2) + ibxy + c$ is differentiable at every point ,the constants

a) 2b=a b) 4b=a c) 2a=b d) a=b

17. If $u = 2x + x^2 - my^2$ is harmonic , then the value of m is

a) 3 b) 2 c) 0 d) 1

18. If the function $f(z) = \frac{z}{1+z}$, $u + iv =$

a) $\frac{x}{x^2+y^2} - \frac{iy}{x^2+y^2}$ b) $\frac{x^2+y^2+x}{(x+1)^2+y^2} + \frac{iy}{(x+1)^2+y^2}$ c) $\frac{x^2+y^2}{(x+1)^2+y^2} + \frac{iy}{(x+1)^2+y^2}$ d) $(x^2 + 5) + 7yi$

19.Any two harmonic conjugates of a given harmonic function u(x,y) differ by

a) x b) y c) xy d) constant

20. The image of the strip 0<x<1 under the transformation w=iz is

a) $0 < u < 1$ b) $0 < v < 1$ c) $1 < u < 2$ d) $1 < v < 2$

Answer key :

1	6	11	16	21
2	7	12	17	22
3	8	13	18	23
4	9	14	19	24
5	10	15	20	25

$Test\ no : 3$ ($Radius\ of\ convergent$)

1. The radius of convergence of $\sum\left(\frac{z^n}{n!}\right)$ is

a) ∞ b) e c) $1/e$ d) 1

2. The radius of convergence of $\sum\left(\frac{n}{n+1}\right)z^n$ is

a) ∞ b) e c) $1/e$ d) 1

3. The radius of convergence of $\sum\left(\frac{n+1}{(n+2)(n+3)}\right)z^n$ is

a) ∞ b) e c) $1/e$ d) 1

4. The radius of convergence of $\sum\left(\frac{n!^2}{2n!}\right)z^n$ is

a) ∞ b) e c) $1/e$ d) 4

5. The radius of convergence of $\sum\left(\frac{(-1)^n}{n}\right)(z-2i)^n$ is

a) ∞ b) e c) $1/e$ d) 1

6. The radius of convergence of $\sum(3+4i)z^n$ is

a) ∞ b) e c) $1/5$ d) 4

7. The radius of convergence of $\sum\left(1+\frac{1}{n}\right)^{n^2}$ is

a) ∞ b) e c) $1/e$ d) 0

8.The invariants points of $w=\frac{z-15}{z-7}$ is

a) 3,-5 b) 3,-3 c) 3,5 d) -3,-5

9.The invariants points of $w=\frac{3z-4}{z-1}$ is

a) $2,-2$ b) $0,1$ c) $\pm i$ d) ± 3

10.The invariants points of $w=\frac{z}{2-z}$ is

a) $2,-2$ b) $0,1$ c) $\pm i$ d) ± 3

11.The invariants points of $w=\frac{z-1}{z+1}$ is

a) $2,-2$ b) $0,1$ c) $\pm i$ d) ± 3

12.The invariants points of $w=\frac{z}{2z-1}$ is

a) $2, -2$ b) $0, 1$ c) $\pm i$ d) ± 3

13.The invariants points of $w = \frac{3z-5}{z+1}$ is

a) $2, -2$ b) $0, 1$ c) $1 \pm 2i$ d) ± 3

14.The invariants points of $w = \frac{z+1}{2z+1}$ is

a) $\pm\frac{1}{\sqrt{2}}$ b) $\pm\frac{1}{\sqrt{3}}$ c) $\pm\frac{1}{2}$ d) $\pm\frac{1}{3}$

15.The transformation $w = z + c$ is said to be

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

16.The transformation $w = az$ is said to be

a) Translation b) Magnification & Rotation c) Inversion d) none

17.The transformation $w = 1/z$ is said to be

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

18.The curve & their images under $w = 1/z$ are given below , state which of the following is true

1) Circle not thro' 0 into circle not thro' 0 2) St. line not thro' 0 into circle thro' 0

3) Circle thro' 0 into St.line not thro' 0 4) St.line thro' 0 into St.line thro' 0

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

19.The angle of rotation at z = 1+i under the map $w = Z^2$ is

a) 45 b) 0 c) 90 d) 180

20.The image of the circle $|z - 3i|$ =under the map 3 $w = 1/z$ is

a) circle b) st.line c) square d) rectangle

Answer key :

1	6	11	16	21
2	7	12	17	22
3	8	13	18	23
4	9	14	19	24
5	10	15	20	25

$Test\ no : 4$ ($Transformations$ & $complex\ integeration$)

1. The image of the strip 0<x<1 under the transformation w=iz is

a) $0 < u < 1$ b) $0 < v < 1$ c) $1 < u < 2$ d) $1 < v < 2$

2. The image of the strip $0 < x < 1$ under the transformation $w = iz$ is

a) $v > 1$ b) $v = 1$ c) $0 < v < 1$ d)) $-1 < v < 0$

3. The image of the strip $0 < x < 1$ under the transformation $u^2 + v^2 = \lambda x$ is

a) $u^2 + v^2 = 1/\lambda$ b) $u = 1/\lambda$ c) $v = 1/\lambda$ d) none

4. The image of the strip $0 < y < 1$ under the transformation $w = 1/z$ is

a) $u^2 + v^2 + v > 0$ b) $u^2 - v^2 - 2cv > 0$ c) $u^2 + v^2 > 0$ d) none

5. The image of the strip $0 < y < 1/2c$ under the transformation $w = 1/z$ is

a) $u^2 + v^2 + 2cv > 0$ b) $u^2 - v^2 - 2cv > 0$ c) $u^2 + v^2 > 0$ d) none

6. The transformation $w = 1/z$ transforms

a) circle not through the origin in the z- plane into the circle through the origin in the w-plane

b) circle through the origin in the z- plane into the st.line passing through the origin in the w-plane

c) st.line not through the origin in the z- plane into the circle through the origin in the w-plane

d) st.line through the origin in the z- plane into the st.line passing through the origin in the w-plane

7.The transformation $w = e^z$ transforms the imaginary axis in the Z axis into

a) a unit circle with center at origin in the W plane

b) a circle of radius 2 with center at origin in the W plane

c) a straight line in the W plane d) an ellipse in the W plane

8.The bilinear transformation that map the points $z_1 = 0, z_2 = -1, z_3 = \infty$

$into\ w_1 = -1, w_2 = -2 - i, w_3 = i$ is

a) $w = \frac{2+iz}{z+2}$ b) $w = \frac{2+iz}{z-2}$ c) $w = \frac{-2+iz}{z+2}$ d) $w = \frac{-2+iz}{z-2}$

9.The bilinear transformation that map the points $z_1 = \infty, z_2 = i, z_3 = 0\ into\ w_1 = 0, w_2 = i, w_3 = \infty$ is

a) $w = 1/z$ b) $w = -1/z$ c) $w = z$ d) $w = iz$

10.The bilinear transformation that map the points $z_1 = 0, z_2 = -i, z_3 = -1$

$into\ w_1 = i, w_2 = 1, w_3 = 0$ is

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

11. If $f(z)$ is an entire function & if $\int \frac{f(z)}{z-a}\,dz=0$ then

a) z=a lies inside C b) z=a lies on the boundary of C c) z=a lies outside of C d) none

12. If $f(z)$ is analytic with in & on C & z=a lies inside C, then $\int \frac{f(z)}{z-a}\,dz$

a) 0 b) $2\pi i f'(a)$ c) $\pi i f(a)$ d) $2\pi i$

13.If f(z) is analytic in a simple closed curve C ,then $\int f(z)\,dz$ is

a) 0 b) $2\pi i f'(a)$ c) $\pi i f(a)$ d) $2\pi i$

14.If C is the positively oriented circl $|z|=2$,then $\int \frac{z}{z^2-1}\,dz$ is

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

15. If C is the unit circle $|z|=1$, then $\int z^m(\bar{z})^{-n}\,dz$ is

a) 0 b) $2\pi imn$ c) $m+n$ d) $m-n$

16. If C is the unit circle $|z|=1$, then $\int \bar{z}\,dz$ is

a) 0 b) πi c) $2\pi i$ d) $3\pi i$

17. If C is a strigh line from z=0 to z=4+2i , then $\int \bar{z}\,dz$ is

a) 0 b) $10+\frac{8i}{3}$ c) $10-\frac{8i}{3}$ d) $8+\frac{10i}{3}$

18. If C is the unit circle $|z|=1$, then $\int z^2\,dz$ is

a) 0 b) $2\pi i$ c) π d) $3\pi i$

19. If C is the unit circle $|z|=1$, then $\int ze^z\,dz$ is

a) 0 b) $2\pi i$ c) π d) $3\pi i$

20. If C is the unit circle $|z|=1$, then $\int zz^{-z}\,dz$ is

a) 0 b) $2\pi i$ c) π d) $3\pi i$

Answer key :

1	6	11	16	21
2	7	12	17	22
3	8	13	18	23
4	9	14	19	24
5	10	15	20	25

$Test\ no: 5$ ($complex\ Integarations$)

1. If C is the unit circle $|z| = 1$, then $\int e^z sinz\ dz$ is

a) 0 b) $2\pi i$ c) π d) $3\pi i$

2. If C is the unit circle $|z| = 1$, then $\int \frac{1}{z^2-4}\ dz$ is

a) 0 b) $2\pi i$ c) π d) $3\pi i$

3. If C is the unit circle $|z| = 1$, then $\int \frac{1}{z^2+2z+2}\ dz$ is

a) 0 b) $2\pi i$ c) π d) $3\pi i$

4. If C is the unit circle $|z| = 1$, then $\int \frac{z^2}{z-3}\ dz$ is

a) 0 b) $2\pi i$ c) π d) $3\pi i$

5. If C is the unit circle $|z| = 1$, then $\int \frac{z^2}{z-3}\ dz$ is

a) 0 b) $2\pi i$ c) π d) $3\pi i$

6. If C is the circle $|z-2| = 3$, then $\int \frac{1}{z-1}\ dz$ is

a) 0 b) $2\pi i$ c) $2\pi i\, e^2$ d) $2\pi i\, e^{-2}$

7. If C is the circle $|z-2| = 3$, then $\int \frac{1}{z}\ dz$ is

a) 0 b) $2\pi i$ c) $2\pi i\, e^2$ d) $2\pi i\, e^{-2}$

8. If C is the circle $|z| = 2$, then $\int \frac{e^z}{(z-2)^2}\ dz$ is

a) 0 b) $2\pi i$ c) $2\pi i\, e^2$ d) $-2\pi i\, e^{-1}$

9. If C is the circle $|z| = 2$, then $\int \frac{e^{-z}}{\left(z-\frac{\pi i}{2}\right)^2}\ dz$ is

a) 0 b) 2π c) $2\pi i\, e^2$ d) $2\pi i\, e^{-2}$

10. If C is the circle $|z| = 2$, then $\int \frac{ze^{-z}}{(z-2)^2}\ dz$ is

a) 0 b) $-\pi i/2$ c) $2\pi i\, e^2$ d) $-2\pi i\, e^{-1}$

11. If C is the circle $|z| = 1$, then $\int \frac{z^2+5}{z-3}\ dz$ is

a) 0 b) $2\pi i$ c) $2\pi i$ d) $-28\pi i$

12. If C is the circle $|z+1| = 1$, then $\int \frac{3z^2+7z+1}{z+1}\, dz$ is

a) 0 b) $2\pi i$ c) $3\pi i$ d) $-6\pi i$

13. If C is the circle $|z| = 2$, then $\int \frac{3z^2+3z-5}{z-1}\, dz$ is

a) 0 b) $2\pi i$ c) $3\pi i$ d) $-6\pi i$

26. If C is the circle $|z| = 1$, then $\int \frac{z^2+5z+6}{z-2}\, dz$ is

a) 0 b) $20\pi i$ c) $2\pi i$ d) $40\pi i$

14. If C is $|z| = R < 1$ then $\int \frac{z^2+1}{z^2-1}\, dz$ is

a) 0 b) $2\pi i$ c) πi d) $2\pi i$

15. If C is the circle $|z| = 1$, then $\int \frac{e^z}{z^5}\, dz$ is

a) $2\pi i/5$ b) $\pi i/12$ c) $2\pi i\, e^2$ d) $2\pi i\, e^{-2}$

16. If C is the circle $|z| = 3$, then $\int \frac{ze^{-z}}{(z-2)^2}\, dz$ is

a) $2\pi i/5$ b) $\pi i/12$ c) $2\pi i\, e^2$ d) $-2\pi i\, e^{-2}$

17. If C is the circle $|z| = 1$, then $\int \frac{e^{iz}}{z^3}\, dz$ is

a) $2\pi i/5$ b) $\pi i/12$ c) $2\pi i\, e^2$ d) $-\pi i$

18. If C is the circle $|z| = 2$, then $\int \frac{e^z}{(z-2)^4}\, dz$ is

a) $2\pi i/5$ b) $\pi i e/3$ c) $2\pi i\, e^2$ d) $-\pi i$

19. If C is a closed curve enclosing the origin, then the value of $\int \frac{1}{z^2 e^z}\, dz$ is

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

20. If C is $|z| = 1$ then $\int \frac{e^z}{z^n}\, dz$ is

a) 0 b) $2\pi i$ c) πi d) $\frac{2\pi i}{(n-1)!}$

Answer key :

1	6	11	16	21
2	7	12	17	22
3	8	13	18	23
4	9	14	19	24

5	10	15	20	25

Test no : 6 (*Residues*)

1. If C is the positively oriented circle $|z - i| = 2$, then $\int \frac{e^z}{z^2+4}\, dz$ is

a) πe^{2i} b) $\frac{\pi}{2}\left(e^{2i} - e^{2i}\right)$ c) $\frac{\pi}{2}\left(e^{2i}\right)$ d) $2\pi e^{2i}$

2.The poles of z cot z are

a) $2\pi n$ b) $n\pi$ c) $(2n + 1)\pi$ d) $(2n - 1)\pi$

3.The residue of $f(z) = \frac{z+1}{2(z-2)}$ at z=2 is

a) 1/5 b) 1/4 c) 1/3 d) 3/2

4.The residue of $f(z) = \frac{4}{z^3(z-2)}$ at a simple pole is

a) 1/5 b) 1/4 c) 1/3 d) 1/2

5.The residue of $f(z) = z\cot\frac{1}{z}$ at z=0 is

a) 1/5 b) 1/4 c) 1/3 d) -1/2

6.The residue of $f(z) = \tan z$ at $z = \pi/2$ is

a) 1/5 b) 1/4 c) 1/3 d) -1

7.The residue of $f(z) = \frac{z+1}{z^2-2z}$ are

a) 1/2 b) $-1/2$ c) 3/2 d) $-3/2$

8.The residue of $f(z) = \frac{3}{e^z-1}$ at z=0 is

a) 1/5 b) 1/4 c) 1/3 d) 3

9.The residue of $f(z) = \frac{z+1}{z^2(z-2)}$ at z=0 is

a) 1/5 b) 1/4 c) 1/3 d) -3/4

10.The residue of $f(z) = \frac{1+2z}{z^2 - z-2}$ at $z = 2$ is

a) 1/5 b) 1/4 c) 5/3 d) -1

11.The residue of $f(z) = \frac{\sin z}{(z-1)^2}$ at $z = 1$ is

a) cos 1 b) sin 1 c) 1/3 d) -1

12.The residue of $f(z) = ze^{1/z}$ at $z = 0$ is

a) 1/5 b) 1/4 c) 1/3 d) 1/2

13. If C is the circle $|z| = 3/2$, then $\int \frac{\cos\pi z^2 + \sin\pi z^2}{(z-1)(z-2)}\, dz$ is

a) 0 b) $2\pi i$ c) $2\pi i\, e^2$ d) $-2\pi i\, e^{-1}$

14. If C is the circle $|z| = 2$, then $\int \frac{e^{3z}}{(z+1)^4}\, dz$ is

a) 0 b) $-\pi i/2$ c) $9\pi i/ e^3$ d) $-2\pi i\, e^{-1}$

15. If C is the circle $|z-1| = 2$, then $\int \frac{z+3z^3}{1-z^2}\, dz$ is

a) 0 b) $-4\pi i$ c) $2\pi i\, e^2$ d) $-2\pi i\, e^{-1}$

16. If C is the circle $|z-1| = 2$, then $\int \frac{\cot z}{z^3+z}\, dz$ is

a) 0 b) $-4\pi i$ c) $2\pi i(1-\cosh 1)$ d) $-2\pi i\, e^{-1}$

17.The singular point of $f(z) = \frac{z+1}{z^2(z^2+1)}$ are

a) 0,i , -i b) $1, i, -i$ c) $0, i$ d) $1, -i$

18. For $f(z) = \frac{e^{2z}}{(z-1)^3}$; Z=1 is a

a) Removable singularity b) Pole of order 2

c)simple pole d) Essential singularity

19. For $f(z) = (z-4)\sin\frac{1}{(z+3)}$; Z= -3 is a

a) Removable singularity b) Pole of order 1

c)simple pole d) Essential singularity

20. For $f(z) = \frac{z-\sin z}{(z^{-3}}$; Z= 0 is a

a) Removable singularity b) Pole of order 3

c)simple pole d) Essential singularity

21. The function $f(z) = \frac{e^z}{z}$, $z = 0$ is

a) not a singular point b) a removable singularity c) simple pole d) essential singularity

22.The Taylor's expansion of n $\sin z$ about the origin is

a) $1 + \frac{z^2}{2!} + \frac{z^4}{4!} + \cdots$ b) $1 - \frac{z^2}{2!} + \frac{z^4}{4!} - \cdots$ c) $1 + z + \frac{z^2}{2!} + \frac{z^3}{3!} + \cdots$ d) $z - \frac{z^3}{3!} + \frac{z^5}{5!} - \cdots$

23. Maclaurin's expansion $z - \frac{z^3}{3!} + \frac{z^5}{5!} - \cdots$ is

a) e^z b) $cosz$ c) $\log(1+z)$ d) $\sin z$

24. In $|z| \le 1$,the series $\sum \left(\frac{z^n}{n^2}\right)$ is

a) convergent but not uniform b) divergent

c) uniformly convergent d) neither convergent nor divergent

25. in the open disc $|z| < 1$, then the series $1 + z + z^2 + z^3 + \cdots$ is

a) uniformly convergent b) convergent c) divergent d) absolutely convergent

26. The Taylor's expansion of n $\cos z$ about the origin is

a) $1 + \frac{z^2}{2!} + \frac{z^4}{4!} + \cdots$ b) $1 - \frac{z^2}{2!} + \frac{z^4}{4!} - \cdots$ c) $1 + z + \frac{z^2}{2!} + \frac{z^3}{3!} + \cdots$ d) $z - \frac{z^3}{3!} + \frac{z^5}{5!} - \cdots$

27. The Taylor's expansion of n $\log(1+z)$ about the origin is

a) $z + \frac{z^2}{2} + \frac{z^3}{3} + \cdots$ b) $z - \frac{z^2}{2} + \frac{z^3}{3} - \cdots$ c) $-z - \frac{z^2}{2} - \frac{z^3}{3} - \cdots$ d) $z - \frac{z^3}{3!} + \frac{z^5}{5!} - \cdots$

28. Tailar's series for $1/z$ about $z = 1$ is

a) $1 + z + z^2 + z^3 + \cdots$ b) $1 + (z-1) + (z-1)^2 + \cdots$

c) $1 - (z-1) + (z-1)^2 - \cdots$ d) $1 + \frac{z}{1!} + \frac{z^2}{2!} + \cdots$

29. The expansion $\frac{1}{(z-1)(z-2)} = -\frac{1}{z}\left(1 + \frac{1}{z} + \frac{1}{z^2} + \cdots\right) - \frac{1}{2}\left(1 + \frac{2}{z} + \left(\frac{2}{z}\right)^2 + \cdots\right)$ is

a) not a valued function b) valued in $1 < |z| < 2$ c) valued in $|z| < 1$ d) valued in $|z| > 2$

30. The only singularity of a single value function f(z) are poles of order 1,2 & at z = -1 & z = 2 with residue at these poles 1 & 2 resp. $f(0) = \frac{7}{4}$ & $f(1) = \frac{5}{2}$ the function f(z) is

a) $1 + \frac{1}{1+z} + \frac{2}{z-2} + \frac{3}{(z-2)^2}$ b) $\frac{7}{4} + \frac{1}{1+z} + \frac{2}{z-2}$ c) $\frac{1}{1+z} + \frac{3}{(z-2)^2}$ d) $1 + \frac{2}{z-2} + \frac{3}{(z-2)^2}$

Answer key :

1	6	11	16	21	26
2	7	12	17	22	27
3	8	13	18	23	28
4	9	14	19	24	29
5	10	15	20	25	30

$Test\ no:$ ($Complex\ analysis - Previous\ Year\ Questions$)

1. The amplitude of a complex number i is

a) 0 b) $\pi/2$ c) π d) 2π

2.The amplitude of the quotient of two complex numbers is

a) the sum of their amplitudes b) the difference of their amplitudes

c) the product of their amplitudes d) the quotient of their amplitudes

3. The $z = x + iy$ then $\bar{z} =$

a) $x^2 + y^2$ b) $x^2 + iy^2$ c) $x^2 - y^2$ d) imaginary

4. If z_1 & z_2 are any two complex numbers, then $\frac{|z_1 + z_2|}{|z_1.z_2|}$ is

a) $\frac{|z_1 + z_2|}{|z_2|}$ b) $\frac{|z_1 + z_2|}{|z_1.|}$ c) $\frac{|z_1 + z_2|}{|z_2||z_1|}$ d) $\frac{|1|}{|z_1|}$ $\frac{|1|}{|z_2|}$

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

a) for all z b) for all z except 1,-1 c) for all z except $i, -i$ d) for all z except $1 + 2i$

6. Which of the following is not an entire function ?

a) e^z b) e^{-z} c) $z^2 - 1$ d)$\log z$

7. If C is $|z| = R < 1$ then $\int \frac{z^2+1}{z^2-1}\,dz$ is

a) 0 b) $2\pi i$ c) πi d) $2\pi i$

8. If $f(z)$ is an entire function & if $\int \frac{f(z)}{z-a}\,dz = 0$ then

a) z=a lies inside C b) z=a lies on the boundary of C c) z=a lies outside of C d) none

9. If $f(z)$ is analytic with in & on C & z=a lies inside C, then $\int \frac{f(z)}{z-a}\,dz$

a) 0 b) $2\pi i f'(a)$ c) $\pi i f(a)$ d) $2\pi i$

10. Which of the following is called C-R equation for the function $f(z) = u + iv$ to be analytic at z ?

a) $u_x = -v_y$ & $u_y = v_x$ b) $u_x = v_y$ & $u_y = -v_x$ c) $u_x = v_y$ & $u_y = v_x$ d) $u_x = -v_x$ & $u_y = v_y$

11.The Taylor's expansion of n $\cos z$ about the origin is

a) $1+\frac{z^2}{2!}+\frac{z^4}{4!}+\cdots$ b) $1-\frac{z^2}{2!}+\frac{z^4}{4!}-\cdots$ c) $1+z+\frac{z^2}{2!}+\frac{z^3}{3!}+\cdots$ d) $z-\frac{z^3}{3!}+\frac{z^5}{5!}-\cdots$

12. The Taylor's expansion of n $\log(1+z)$ about the origin is

a) $z+\frac{z^2}{2}+\frac{z^3}{3}+\cdots$ b) $z-\frac{z^2}{2}+\frac{z^3}{3}-\cdots$ c) $-z-\frac{z^2}{2}-\frac{z^3}{3}-\cdots$ d) $z-\frac{z^3}{3!}+\frac{z^5}{5!}-\cdots$

13. If z_1 & z_2 are the image of the complex plane of two diametrically opposite point on the Rieman's sphere then $\overline{z_1 z_2}$ is

a) 0 b) 1 c) -1 d) i

14. in the open disc $|z|<1$, then the series $1+z+z^2+z^3+\cdots$ is

a) uniformly convergent b) convergent c) divergent d) absolutely convergent

15. If C is the unit circle $|z|=1$, then $\int \frac{z^2}{z-3}\,dz$ is

a) 0 b) $2\pi i$ c) π d) $3\pi i$

16. If C is the circle $|z|=3$, then $\int \frac{e^z}{z-2}\,dz$ is

a) 0 b) $2\pi i$ c) $2\pi i\, e^2$ d) $2\pi i\, e^{-2}$

17. $\lim_{z\to 2i}(2x+iy^2)^2 =$

a) $8i$ b) $-8i$ c) 16 d) $4i$

18. The radius of convergence of $\sum\left(\frac{z^n}{n!}\right)$ is

a) ∞ b) e c) $1/e$ d) 1

19. The image of the strip 0<x<1 under the transformation w=iz is

a) $0<u<1$ b) $0<v<1$ c) $1<u<2$ d) $1<v<2$

20. If C is the circle $|z|=1$, then $\int \frac{e^z}{z^5}\,dz$ is

a) $2\pi i/5$ b) $\pi i/12$ c) $2\pi i\, e^2$ d) $2\pi i\, e^{-2}$

21. If C is the circle $|z+1|=1$, then $\int \frac{3z^2+7z+1}{z+1}\,dz$ is

a) 0 b) $2\pi i$ c) $3\pi i$ d) $-6\pi i$

22. The equation $|z+4i|+|z-4i|=10$ represents

a) Circle b) ellipse c) parabola d) hyperbola

23. Maclaurin's expansion $z-\frac{z^3}{3!}+\frac{z^5}{5!}-\cdots$ is

a)e^z b)$cosz$ c) $\log(1+z)$ d) $\sin z$

24.The invariants points of $w=\frac{z-15}{z-7}$ is

a) 3,-5 b) 3,-3 c) 3,5 d) -3,-5

25.The bilinear transformation that map the points $z_1=\infty, z_2=i, z_3=0$ *into* $w_1=0, w_2=i, w_3=\infty$ is

a)$w=1/z$ b) $w=-1/z$ c) $w=z$ d) $w=iz$

26. If C is the circle $|z|=1$, then $\int \frac{z^2+5z+6}{z-2}\,dz$ is

a) 0 b) $20\pi i$ c) $2\pi i$ d) $40\pi i$

27.The Taylor's expansion of n $\sin z$ about the origin is

a) $1+\frac{z^2}{2!}+\frac{z^4}{4!}+\cdots$ b) $1-\frac{z^2}{2!}+\frac{z^4}{4!}-\cdots$ c) $1+z+\frac{z^2}{2!}+\frac{z^3}{3!}+\cdots$ d) $z-\frac{z^3}{3!}+\frac{z^5}{5!}-\cdots$

28.In $|z|\le 1$,the series $\sum\left(\frac{z^n}{n^2}\right)$ is

a) convergent but not uniform b) divergent

c) uniformly convergent d) neither convergent nor divergent

29. Let $f(z)=\begin{cases}\frac{Re\,z}{|z|} & ,z\neq 0\\ 0 & ,\ z=0\end{cases}$ and $g(z)=\begin{cases}\frac{x^3(1+i)-y^3(1-i)}{x^2+y^2} & ,z\neq 0\\ 0 & ,z=0\end{cases}$

a) both f(z) & g(z) are continues at the origin

b) both f(z) & g(z) are not continues at the origin

c) f(z) continues at the origin & g(z) is not continues at the origin

d) f(z) is not continues at the origin & g(z) is continues at the origin

30.If $f(z)=u+iv$ is analytic & $u=2x(1-y)$ then $f(z)=$

a) $2z+iz^2$ b) $2z-iz^2$ c) $z+iz^2/2$ d) $z-iz^2/2$

31.The multiplicative identity if C is

a)(0,0) b) (1,1) c) (0,1) d) (1,0)

32. $\left(\frac{1+cos\frac{\pi}{8}+isin\frac{\pi}{8}}{1+cos\frac{\pi}{8}-isin\frac{\pi}{8}}\right)^8 =$

a) 1+i b) 1-i c) 1 d) -1

33. If α is a complex number such that $\alpha^2+\alpha+1=0$ then $\alpha^{31}=$

a) α b) α^2 c) 0 d) 1

34. If p is a complex number & $|q| = 1$ then $\left|\frac{p-q}{\bar{p}q-1}\right|$ is

a) i b) -i c) 1 d) -1

35.If C is a closed curve enclosing the origin , then the value of $\int \frac{1}{z^2e^z}\, dz$ is

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

36.If $f(z) = u + iv$ is analytic & $v = 2xy$ then $f(z) =$

a) $z^4 + c$ b) $z^2 + c$ c) $z + c$ d) $z - iz^2/2$

37. If $f(z) = (x^2 + ay^2 - 2xy) + i(bx^2 - y^2 + 2xy)$ is analytic ,then the value of a, b are respectually

a) -1,1 b) -1,2 c) 1,-1 c) 2,-1

38.The residue of $f(z) = \frac{4}{z^3(z-2)}$ at a simple pole is

a) 1/5 b) 1/4 c) 1/3 d) 1/2

39. If C is the circle $|z| = 1$, then $\int \frac{z^2+5}{z-3}\, dz$ is

a) 0 b) $2\pi i$ c) $2\pi i$ d) $-28\pi i$

40.The transformation $w = e^z$ transforms the imaginary axis in the Z axis into

a) a unit circle with center at origin in the W plane

b) a circle of radius 2 with center at origin in the W plane

c) a straight line in the W plane d) an ellipse in the W plane

41.The bilinear transformation that map the points $z_1 = 0, z_2 = -1, z_3 = \infty$ $into\ w_1 = -1, w_2 = -2 - i, w_3 = i$ is

a) $w = \frac{2+iz}{z+2}$ b) $w = \frac{2+iz}{z-2}$ c) $w = \frac{-2+iz}{z+2}$ d) $w = \frac{-2+iz}{z-2}$

42.The invariants points of $w = \frac{z+1}{2z+1}$ is

a) $\pm\frac{1}{\sqrt{2}}$ b) $\pm\frac{1}{\sqrt{3}}$ c) $\pm\frac{1}{2}$ d) $\pm\frac{1}{3}$

43.The poles of z cot z are

a) $2\pi n$ b) $n\pi$ c) $(2n + 1)\pi$ d) $(2n - 1)\pi$

44. If $u = 2x + x^2 - my^2$ is harmonic , then the value of m is

a) 3 b) 2 c) 0 d) 1

45.The residue of $f(z) = \frac{z+1}{2(z-2)}$ at z=2 is

a) 1/5 b) 1/4 c) 1/3 d) 3/2

46. .$\lim_{z\to 2}\left(\frac{z^2-4}{z-2}\right) =$

a) 2 b) 4 c) 1 d) 8

46. If $f(z) = a(x^2 - y^2) + ibxy + c$ is differentiable at every point ,the constants

a) 2b=a b) 4b=a c) 2a=b d) a=b

47.The angle of rotation at z = 1+i under the map $w = Z^2$ is

a) 45 b) 0 c) 90 d) 180

48.Tailar's series for 1/z about z = 1 is

a) $1 + z + z^2 + z^3 + \cdots$ b) $1 + (z-1) + (z-1)^2 + \cdots$

c) $1 - (z-1) + (z-1)^2 - \cdots$ d) $1 + \frac{z}{1!} + \frac{z^2}{2!} + \cdots$

49.The function $f(z) = |z|^2$ is

a) differentiable at z = 0 b) no where differentiable c) not harmonic d) differentiable at z ≠ 0

50. If the function $f(z) = \frac{z}{1+z}$,$u + iv =$

a) $\frac{x}{x^2+y^2} - \frac{iy}{x^2+y^2}$ b) $\frac{x^2+y^2+x}{(x+1)^2+y^2} + \frac{iy}{(x+1)^2+y^2}$ c) $\frac{x^2+y^2}{(x+1)^2+y^2} + \frac{iy}{(x+1)^2+y^2}$ d) $(x^2+5) + 7yi$

51.The image of the circle $|z - 3i|$ =under the map 3 $w = 1/z$ is

a) circle b) st.line c) square d) rectangle

52. If C is $|z| = 1$ then $\int \frac{e^z}{z^n}\, dz$ is

a) 0 b) $2\pi i$ c) πi d) $\frac{2\pi i}{(n-1)!}$

53.The singular point of $f(z) = \frac{z+1}{z^2(z^2+1)}$ are

a) 0,i , -i b) 1, i , −i c) 0, i d) 1, −i

54.Any two harmonic conjugates of a given harmonic function u(x,y) differ by

a) x b) y c) xy d) constant

55. The function $f(z) = \frac{e^z}{z}$, $z = 0$ is

a) not a singular point b) a removable singularity c) simple pole d) essential singularity

53.The residue of $f(z) = \frac{z+1}{z^2-2z}$ are

a) $1/2$ b) $-1/2$ c) $3/2$ d) $-3/2$

54. The radius of convergence of $\sum\left(1+\frac{1}{n}\right)^{n^2}$ is

a) ∞ b) e c) $1/e$ d) 0

55.The bilinear transformation that map the points $z_1=0, z_2=-i, z_3=-1$

into $w_1=i, w_2=1, w_3=0$ is

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

56. If C is the positively oriented circle $|z-i|=2$, then $\int \frac{e^z}{z^2+4}\,dz$ is

a) πe^{2i} b) $\frac{\pi}{2}\left(e^{2i}-e^{2i}\right)$ c) $\frac{\pi}{2}\left(e^{2i}\right)$ d) $2\pi e^{2i}$

57. The transformation $w=1/z$ transforms

a) circle not through the origin in the z- plane into the circle through the origin in the w-plane

b) circle through the origin in the z- plane into the st.line passing through the origin in the w-plane

c) st.line not through the origin in the z- plane into the circle through the origin in the w-plane

d) st.line through the origin in the z- plane into the st.line passing through the origin in the w-plane

58.The only singularity of a single value function f(z) are poles of order 1,2 & at z = -1 & z = 2 with

residue at these poles 1 & 2 resp. $f(0)=\frac{7}{4}$ & $f(1)=\frac{5}{2}$ the function f(z) is

a) $1+\frac{1}{1+z}+\frac{2}{z-2}+\frac{3}{(z-2)^2}$ b) $\frac{7}{4}+\frac{1}{1+z}+\frac{2}{z-2}$ c) $\frac{1}{1+z}+\frac{3}{(z-2)^2}$ d) $1+\frac{2}{z-2}+\frac{3}{(z-2)^2}$

59.The expansion $\frac{1}{(z-1)(z-2)}=-\frac{1}{z}\left(1+\frac{1}{z}+\frac{1}{z^2}+\cdots\right)-\frac{1}{2}\left(1+\frac{2}{z}+\left(\frac{2}{z}\right)^2+\cdots\right)$ is

a) not a valued function b) valued in $1<|z|<2$ c) valued in $|z|<1$ d) valued in $|z|>2$

Answer key :

1	11	21	31	41	51
2	12	22	32	42	52
3	13	23	33	43	53
4	14	24	34	44	54
5	15	25	35	45	55
6	16	26	36	46	56
7	17	27	37	47	57
8	18	28	38	48	58

9	19	29	39	49	59
10	20	30	40	50	60