Online Examinations (Even Sem/Part-I/Part-II Examinations 2020 - 2021

Course Name - –Complex Analysis
Course Code - MSCMC202

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Mark only one oval.

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- B.A.(Eng)

Answer all the questions. Each question carry one mark.

9. 1.

for the function $f(z) = e^{z}, z = \infty$

Mark only one oval.

isolated essential singularity

Option 1

pole

Option 2

ordinary point

Option 3

none of these

Option 4

10. 2.

Let f be meromorphic function. Then its

Mark only one oval.

Zeroes are isolated points but poles are not so

Option 1

Poles are isolated but zeroes are not so

Option 2

Both poles and zeroes are isolated points

Option 3

Neither zeroes nor poles are isolated

Option 4

11. 3.

Let f be an entire function such that $f(iy) = \exp(iy), 0 \leq y \leq 1$. then

Mark only one oval.

$f(x+iy) = \exp(x+iy)$ for every x and y

- Option 1

$f(x+iy) = \exp\overline{(iy)}$

- Option 2

$f(x+iy) = \exp(x+iy)$ for every x and $0 \leq y \leq 1$.

- Option 3

None of the above

- Option 4

12. 4. A non-constant analytic function maps

Mark only one oval.

- Open sets into closed sets
- Closed sets into open sets
- Open sets into open sets
- Closed sets into closed sets

13. 5.

$f(z) = z^n.cos\frac{1}{z}(z \neq 0)$. Then

Mark only one oval.

- f is entire
- f has removable singularity
- f has a pole at z=0
- f has the essential singularity at z=0

14. 6.

Number of poles of the function $f(z) = \tan\left(\frac{1}{z}\right)$ is:

Mark only one oval.

- 2
- 4
- Infinite
- None of these

15. 7. Which of the following functions is not analytic?

Mark only one oval.

$f(z) = z^6$

- Option 1

$f(z) = \frac{1}{z^4}, z \neq 0$

- Option 2

$f(z) = \log r + i\theta$

- Option 3

$f(z) = \frac{1}{(z-1)^3}$

- Option 4

16. 8.

The transformation $z \to \frac{1}{z}$ maps a straight line into a

Mark only one oval.

- Straight line passing through the origin
- Straight line not passing through the origin
- Circle passing through origin
- Circle not passing through origin

17. 9.

If a function f is analytic within and on a simple closed contour C, then $\int_C f(z)dz$ is

Mark only one oval.

- 0
- Non-zero
- 1
- -1

18. 10.

The function $\sin z$ is analytic in

Mark only one oval.

$C \cup \{\infty\}$

Option 1

C except on the negative real axis

Option 2

$C \setminus \{0\}$

Option 3

C

Option 4

19. 11.

Residue of $\frac{z^2}{(z^2+1)^2}$ at $z=-i$ is:

Mark only one oval.

$-\frac{i}{4}$

Option 1

$\frac{i}{4}$

Option 2

$\frac{1}{4}$

Option 3

$\frac{i}{2}$

Option 4

20. 12.

The function $f(z) = \tan z$ is:

Mark only one oval.

- Continuous everywhere
- Analytic in finite complex plane
- Analytic everywhere except the points where $\cos z = 0$
- Option 3
- None of these

21. 13.

The set $\{z \in C : |z-2| + |z-1| < 3\}$ describes

Mark only one oval.

The interior of a disc

Option 1

The interior of an ellipse

Option 2

The null set ϕ

Option 3

The whole complex plane C

Option 4

22. 14.

$\int_C \frac{1}{z} dz,$ where $C: |z-2| = 1$ is

Mark only one oval.

- ( ) 0
- $2\pi i$
  ( ) Gossip column
- ( ) 1
- $2\pi i$
  ( ) Option 4

23. 15.

$f(z)=e^z$ is conformal

Mark only one oval.

- At every point in C
- At every point except 0 in C
- Only at $z=0$
- At no point in C
- Option 4

24. 16.

If $f(z) = \log z / (1+z^2)^2$, $\operatorname{Res} f(z)$ at $z = i$ is:

Mark only one oval.

$\frac{1}{4}\left(\frac{\pi}{2}+i\right)$

Option 1

$\left(\frac{\pi}{2}+i\right)$

Option 2

$\frac{1}{4}\left(\frac{\pi}{2}-i\right)$

Option 3

None of these

25. 17.

The analytic function whose real part is $e^x \cos y$ is:

Mark only one oval.

$e^z + ic$

Option 1

e^{2z}

Option 2

xe^z

Option 3

None of these

Option 4

26. 18.

Let A=$\{z \in C: |z-2| + |z+1| \geq 3\}$

Mark only one oval.

- A bounded, closed subset of C
- A is an unbounded proper subset of C
- A=C
- A is an unbounded subset of C which is not closed.

27. 19.

The value of the integral $\int_C \frac{e^z}{(z-1)(z+3)^2} dz$, where C is the circle $|z| = \frac{3}{2}$ and the integral is taken in positive sense, is

Mark only one oval.

- 0
- $\frac{\pi e i}{8}$ Option 2
- $-\frac{\pi e i}{8}$ Option 3
- $\frac{\pi i(e - 5e^{-3})}{8}$ Option 4

28. 20.

$\int_C \frac{z^3+2z+1}{(z+1)^3}dz,$ where $C:|z|=2$ is

Mark only one oval.

- 0
- 1
- Option 3: $-6\pi i$
- Option 4: $4\pi i$

29. 21.

If $f(z) = \frac{e^z}{z-1}$, $z = 1$, then

Mark only one oval.

f has a simple pole at z=1 and residue at z=0 is -1

Option 1

f has simple pole at z=1 and there exists a complex number c such that $f(z) - \frac{c}{z-1}$ is the derivative of an analytic function in a neighbour-hood of 1.

Option 2

f has simple pole at z=1 where its residue is 1.

Option 3

For no complex number c the function $f(z) - \frac{c}{z-1}$ is the derivative of an analytic function in a neighbour-hood of 1.

Option 4

30. 22.

Which of the following functions $f(z)$ is analytic and bounded where $f(z)$ =

Mark only one oval.

$\sin z$

Option 1

. $\cos z$

Option 2

Any polynomial of degree more than one

Option 3

None of these

Option 4

31. 23.

The equation $z\bar{z} + i\bar{z} - 3$ describes

Mark only one oval.

- A straight line
- An ellipse
- A circle
- A pair of straight line

32. 24.

Let $E = \{z \in C : |z| \rangle 1\} \cup \{i\}$, then

Mark only one oval.

- E is open but not closed in C
- E is closed but not open in C
- E is neither open nor closed in C
- E is both open and closed in C

33. 25. A real valued function of a complex variable

Mark only one oval.

- Has derivative zero
- Does not have derivative
- Has derivative not necessarily zero
- Either has derivative zero or the derivative does not exist

34. 26.

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

Mark only one oval.

Circle $u^2 + v^2 + 4v = 0$

Option 1

Circle $u^2 + v^2 = 4$

Option 2

Straight line

Option 3

None of them

Option 4

35. 27.

Let $f(z) = \frac{e^z}{z^3}$ if $z \neq 0$. The residue of at z=0

Mark only one oval.

- 0
- 1
- $2\pi i$ Option 3
- ½ Option 4

36. 28. Under the stereographic projection, the south pole goes to

Mark only one oval.

$(0,0)$

Option 1

$(1,0)$

Option 2

$(0,1)$

Option 3

$(0,-1)$ in the complex plane

Option 4

37. 29. If f is a bounded entire function then f is

Mark only one oval.

- Non-constant
- Not differentiable
- Not analytic
- Constant

38. 30.

$f(z) = cosec\frac{1}{z}$, then for f(z), '0' is

Mark only one oval.

An isolated singularity

Option 1

A non-isolated singularity

Option 2

An isolated essential singularity

Option 3

A non-isolated essential singularity

Option 4

39. 31.

Number of zeros of the function $f(z) = \sin\left(\frac{1}{z}\right)$ is:

Mark only one oval.

- 3
- 4
- Infinite
- none of these

40. 32. A Mobius transformation which transform the upper half plane into the lower half is

Mark only one oval.

$w = \bar{z}$

- Option 1

$w = \frac{z-1}{z+i}$

- Option 2

$w = \frac{1}{z}$

- Option 3

$w = \frac{z+i}{z-i}$

- Option 4

41. 33.

Let $A = \{z \in C : |z-2| + |z+1| \geq 3\}$, then

Mark only one oval.

- A is bounded, closed subset of C
- A is an unbounded proper subset of C
- A=C
- A is an unbounded subset of C which is not closed

42. 34. In complex form Cauchy-Riemann equation takes the form

Mark only one oval.

$$\frac{\partial f}{\partial x} = i\frac{\partial f}{\partial y}$$

Option 1

$$\frac{\partial f}{\partial x} = \frac{1}{i}\frac{\partial f}{\partial y}$$

Option 2

$$i\frac{\partial f}{\partial x} = -\frac{\partial f}{\partial y}$$

Option 3

$$\frac{\partial f}{\partial x} = -\frac{1}{i}\frac{\partial f}{\partial y}$$

Option 4

43. 35.

The value of the integral $\int_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-4)(z-2)} dz$, where C is the circle $|z| = 3$ and integration is taken anti-clockwise, is

Mark only one oval.

$-2\pi i$

- [ ] Option 1

πi

- [ ] Option 2

$-\pi i$

- [ ] Option 3

$2\pi i$

- [ ] Option 4

44. 36.

Residue of $\frac{z^2}{(z^2+1)^2}$ at $z = i$ is:

Mark only one oval.

$-\frac{i}{4}$

Option 1

$\frac{i}{4}$

Option 2

$\frac{1}{4}$

Option 3

$\frac{i}{2}$

Option 4

45. 37.

The analytic function $w = u + iv$ where $u = e^{-x}\{(x^2 - y^2)\cos y + 2xy\sin y\}$ is

Mark only one oval.

$e^{-x}\{(x - iy)^2(\cos y - i\sin y\}$

Option 1

$e^{-x}\{(x - iy)^2(\cos y + i\sin y\}$

Option 2

$e^{-x}\{(x + iy)^2(\cos y - i\sin y\}$

Option 3

$e^{-x}\{(x - iy)^2(\cos y + i\sin y\}$

Option 4

46. 38.

The cross ratio (z_1, z_2, z_3, z_4) is real iff

Mark only one oval.

- The four points lie on a circle
- The four points lie on a straight line

The four points lie on a circle or on a straight line according as none of z_1, z_2, z_3, z_4 is ∞ or one of z_1, z_2, z_3, z_4 is ∞

None of the above

- Option 3
- Option 4

47. 39.

Let $f(z) = \frac{1}{z}$, then f is

Mark only one oval.

Not continuous on $\{z \in C : 0 < |z| \leq 1\}$	Continuous but not uniformly continuous on $\{z \in C : 0 < |z| \leq 1\}$

- Option 1
- Option 2
- Uniformly continuous on
- None of these

48. 40.

The value of the integral $\int_C \frac{dz}{z^2+9}$, where C is the ellipse $\frac{x^2}{4}+\frac{y^2}{1}=1$ and the integral is taken in positive sense, is

Mark only one oval.

0

Option 1

$2\pi i$

Option 2

$-\pi i$

Option 3

πi

Option 4

49. 41.

If $f(z) = \frac{\sin 2z}{(z+1)^3}$, then $\operatorname{Res} f(z)$ at $z = -1$ is:

Mark only one oval.

$2 \sin 2$

Option 1

$-2 \sin 2$

Option 2

0

$4 \sin 3$

Option 4

50. 42.

The Mobius transformation which maps the points $z_1 = -1, z_2 = 0, z_3 = 1$ onto the points $w_1 = -i, w_2 = 1, w_3 = i$ respectively is

Mark only one oval.

$w = Re(z)$

Option 1

$w = Im(z)$

Option 2

$w = \frac{z-i}{z+i}$

Option 3

$w = \bar{z}$

Option 4

51. 43.

A Mobius transformation $f(z)\frac{az+b}{cz+d}$, $ad-bc\neq 0$, other than the identity transformation, has

Mark only one oval.

- No fixed point
- Only one fixed point
- At most two fixed points
- Three or more than three fixed points

52. 44.Which of the following functions is analytic?

Mark only one oval.

$f(x+iy)=\exp(iy)$

- Option 1

$f(x+iy)=x$

- Option 2

$f(x+iy)=iy$

- Option 3

$f(x+iy)=x+iy$

- Option 4

53. 45.

The value of the integral $\int_C \frac{e^z}{z^3}\,dz$, where $C: |z| = 1$ is

Mark only one oval.

- 0
- 1
- πi Option 3
- $2\pi i$ Option 4

54. 46.

When $0 < |z| < 4$, the expansion of $\dfrac{1}{4z - z^2}$ is:

Mark only one oval.

$$\sum_{n=0}^{\infty} \frac{z^{n+1}}{4^{n+1}}$$

Option 1

$$\sum_{n=0}^{\infty} \frac{(-1)^n z^{n+1}}{4^{n+1}}$$

Option 2

$$\sum_{n=0}^{\infty} \frac{z^{n-1}}{4^{n+1}}$$

Option 3

all of these

55. 47. The set of all Bilinear transformation form an algebraic structure under the composition of product of transformations this algebraic structure is

Mark only one oval.

- An algebraic group
- A cycle group
- A non-abelian grou
- A ring

56. 48.

$f: C \rightarrow C$ be analytic such that $f\left(\frac{1}{n}\right) = \frac{1}{n^2}$, n=1,2, Then

Mark only one oval.

- F is a bounded function
- There does not exists such a function
- $f(z) = z^2, \forall\, z \in C$ — Option 3
- $f(z) = z, \forall\, z \in C$ — Option 4

57. 49.

Let $f(z) = \begin{cases} \dfrac{|z|}{\operatorname{Re} z}, \operatorname{Re} z \neq 0 \\ 0, \operatorname{Re} z = 0 \end{cases}$ then $f(z)$

Mark only one oval.

Has a non-zero limit as $z \to 0$

Option 1

Is differentiable at $z=0$

Option 2

Is continuous but not differentiable at $z=0$

Option 3

Is neither continuous nor differentiable at $z=0$

Option 4

58. 50.

The value of $\int_C \frac{dz}{z+2}$, where $C: |z| = 1$ is

Mark only one oval.

$\frac{\pi}{2}$

- Option 1
- 1

$2\pi i$

- Option 3
- 0

59. 51. Which of the following is a bilinear transformation :

Mark only one oval.

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

Option 1

$$w = \frac{(2+3i)z+i}{-13iz+(2-3i)}$$

Option 2

$$w = z^2$$

Option 3

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

Option 4

60. 52.

The value of the integral $\int_{|z|=1} \frac{\sin z}{z} dz$ is

Mark only one oval.

- 0
- 1
- $2\pi i$ Option 3
- 2π Option 4

61. 53.A circle on the Riemann sphere passing through the north pole describes

Mark only one oval.

- A straight line in the complex plane
- A circle in the complex plane
- An ellipse in the complex plane
- A line-segment in the complex plane

62. 54.

The function $f(z) = |z|$ is analytic

Mark only one oval.

- Everywhere
- Nowhere
- Only at $z = 0$
  Option 3
- Everywhere except at $z = 0$
  Option 4

63. 55.

Let α be a zero of f of order m and also be a zero of φ of order n $(m > n)$. Then for the function $f.\varphi,\alpha$ is a

Mark only one oval.

- Pole of order m+n
- Zero of order m+n
- Pole of order m-n
- Zero of order m-n

64. 56.

$z = 0$ for the function $f(z) = \log z$ is:

Mark only one oval.

- Isolated singularity
- Pole
- Non-isolated singularity
- None of these

65. 57.

The value of the integral $\int_C \frac{3z^{99}+1}{z^2-1} dz$, where C is the ellipse $x^2 + 2y^2 = 8$ described in the positive sense, is

Mark only one oval.

- 0
- Option 2: $2\pi i$
- Option 3: $4\pi i$
- Option 4: $6\pi i$

66. 58.

The function $w(z) = -\left(\frac{1}{z} + bz\right), -1 < b < 1,$ maps $|z| < 1$ onto

Mark only one oval.

- A half plane
- Exterior of a circle
- Exterior of an ellipse
- Interior of an ellipse

67. 59.

Let f is continuous in an open connected set D and $\int_C f(z)dz = 0$ for each piecewise differentiable curve C in D. Then

Mark only one oval.

- f is differentiable on C
- f is analytic on C
- f is analytic in D
- f is not necessarily analytic in D

68. 60.

$$f(z) = \frac{1}{(z-1)^{1/2}}$$

Mark only one oval.

is analytic in the region $|z| < 2$

- [ ] Option 1

has a pole at z=1

- [ ] Option 2

has a branch point at z=1

- [ ] Option 3

has an essential singularity at z=1

- [ ] Option 4